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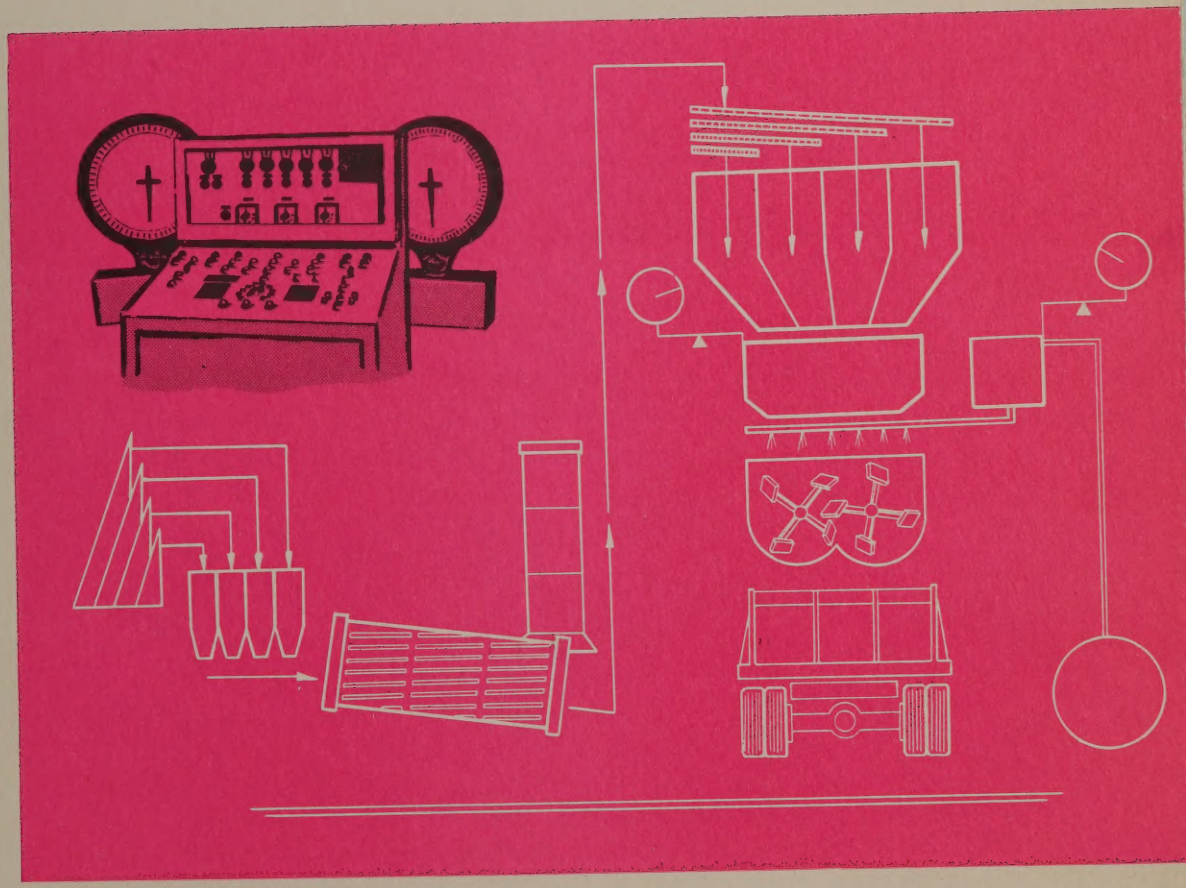
MATERIALS METHOD 5

PLANT INSPECTION OF BITUMINOUS CONCRETE



APRIL 1967

NEW YORK STATE DEPARTMENT OF PUBLIC WORKS
BUREAU OF MATERIALS

STATE OF NEW YORK

DEPARTMENT OF PUBLIC WORKS

MATERIALS METHOD 5

PLANT INSPECTION OF BITUMINOUS CONCRETE

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MATERIALS METHOD 5
"PLANT INSPECTION OF BITUMINOUS CONCRETE"

PREFACE

It is the purpose of Materials Method 5 to describe Departmental practices involved in the plant inspection of bituminous concrete mixes. Full conformance with Materials Method 5 will provide uniform inspection procedures at the plant, thus minimizing the risk both to the Producer and the Department of the placement of unacceptable material in delivery vehicles. A secondary purpose is to provide adequate documentation of the acceptability of the material as it is placed in the truck.

It should also be noted that the inspection procedures outlined herein are, in fact, inspection procedures conducted on behalf of the purchaser (the Department) and are in no way to be construed as an assumption of responsibility by the Department for the production of acceptable material. Regardless of the depth of inspection or the details thereof, it remains the responsibility of the Contractor to furnish every batch of material in compliance with the Specifications.

The inspection operations conducted at the plant do not relieve either the Producer or the Contractor of the responsibility to place in the pavement only bituminous concrete fully in compliance with the Specifications. Although the inspection procedures detailed herein may appear quite comprehensive, they are limited to sampling rates practical for accomplishment by one individual and it is therefore possible, although not probable, for deliveries of segregated, contaminated or otherwise unacceptable material to be made to the project. In such event, it is the responsibility of the Project Engineer to reject the unacceptable material whenever such accidents are apparent. It is also the responsibility of the Project Engineer to be certain of the placement temperature.

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Plant Inspectors may suggest methods for improvement of plant operation but they are not authorized to accept unacceptable material pending correction of the conditions which produced it; nor do such suggestions by Inspectors bind the Department to the acceptance of material outside the Specifications in the event that the application of an Inspector's recommendation did not have the expected result.

The testing frequencies outlined in this method should be followed as closely as possible. However, it is recognized that in certain situations the Inspector must emphasize one test and/or inspection procedure to the detriment of others in order to insure correction of extreme plant deficiencies. Therefore, so long as the District is kept informed and the situation is noted in his diary, the Inspector may deviate at times from strict conformance to these testing frequencies.

Materials Method 5 consists of eleven (11) sections (5.0 - 5.10). General inspection and administrative procedures are outlined in 5.0. The Inspector should thoroughly familiarize himself with this section along with 5.1, which describes details of automatic recorded batching. The remaining sections supplement 5.0 and 5.1 by detailing specific test methods and approval procedures. These should be read at least once with complete familiarity obtained through practice.

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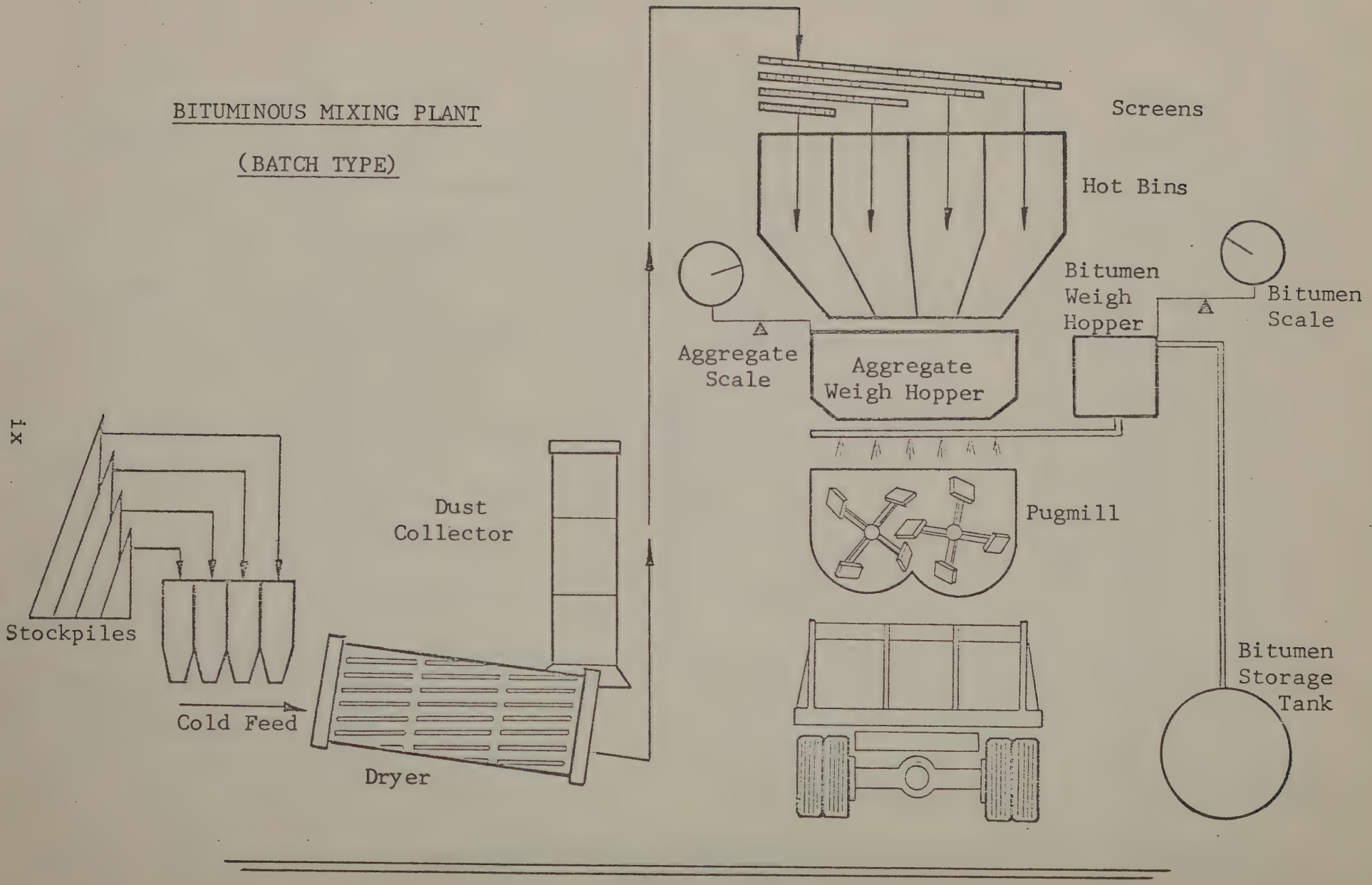
SUMMARY OF ROUTINE INSPECTION ACTIVITIES

	Activity	Minimum Requirements	Form Used	Reference*
Control Tests	Uniformity Test	1 test per 100 batches**	BR 163	MM 5.3
	Hot Bin Analysis	1 test per 4 uniformity tests**	BR 161	MM 5.2
	Bitumen Extraction	1 test per day (top mixes)	BR 160	MM 5.4
	Moisture Test	1 per week per bin**	Diary	MM 5.7
Equipment Checks	Automation Check	Weekly, as required	---	MM 5.1
	Recordation Check	Daily	---	MM 5.1
	Scale Test	60 days, as required	BR 185	MM 5.5
	Meter Test	60 days, as required	Diary	MM 5.6
Sampling	Bitumen Sampling	1 per shipment	BR 170	MM 8.2
	Mix Sampling	1 per week (top mixes)	BR 170	---
	BPR Sampling	As ordered ***	---	---
Paperwork	Review Recordation	Daily	BR 188	---
	Acceptance Issue	Daily, each project	BR 86	---
	Maintain Diary, Records	Daily	Diary	---

* in addition to Materials Method 5.0 "GENERAL METHOD - BATCH PLANTS"
** may be reduced at the discretion of the District Engineer
*** covered by separate instructions

BITUMINOUS MIXING PLANT

(BATCH TYPE)



NEW YORK STATE
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"PLANT INSPECTION OF BITUMINOUS CONCRETE"
GENERAL METHOD - BATCH PLANTS

I. SCOPE

This method describes specific procedures for inspecting, sampling, testing and reporting on plant mixed bituminous concrete to be used on Department projects to insure conformance with Specifications. In addition to this Materials Method and its supplements, the Inspector should have in his possession Materials Method 8.2 "SAMPLING BITUMINOUS MATERIALS."

II. GENERAL

Plant mixed bituminous concrete for use on Department projects is produced by Department approved plants under the supervision of resident Plant Inspectors assigned by the District Engineer. Yearly Departmental plant approval by the Division of Operation and Maintenance is necessary before any material from that plant may be allowed on any project. Details of such approval are outlined in Materials Method 5.8 "PLANT APPROVAL."

For all Maintenance Special projects and for all Department Contract projects, an approved job mix formula including information as to mix gradation and bitumen content for each type of mix produced must be in the possession of the Plant Inspector before any material from that plant is allowed on the project. Details of such approval are outlined in Materials Method 5.9 "JOB MIX FORMULA APPROVAL."

The Plant Inspector pursues a program of inspection, sampling and testing to assure compliance with provisions of the applicable Specifications. In particular, he is responsible for the following:

1. Insuring that only accepted materials are incorporated in the mixes.

2. Inspecting plant production to insure that mixes comply with the approved job mix formulas.

3. Inspecting plant equipment and operating procedures to insure uniform production.

4. Sampling bitumen and mixes for Laboratory analysis.

5. Maintaining production records and other administrative procedures.

III. ACCEPTANCE OF MATERIALS

A. BITUMEN

Reference is made to Materials Method 8.2 "SAMPLING BITUMINOUS MATERIALS" which shall be kept on file in the Inspector's Office.

Evidence of acceptability for the bituminous material shall be the following documents:

(1) Certified Shipment Notice (BR-162)

(2) Receipted Bitumen Sample Form (BR-170)

Each delivery of bitumen to the plant must be accompanied by a Form BR-162 which the Inspector files as part of the plant records for evidence of acceptability.

Form BR-170 shall be completed by the Inspector each time that the bitumen is sampled at the plant. In submitting samples to the Laboratory, the last copy of the Form BR-170 shall be affixed to the sample container and the first copy shall be sent separately. Upon receipt of the sample by the Bureau of Materials, the first copy shall be stamped "RECEIVED" and returned to the District. The receipted copy should be delivered to the plant as soon as possible and filed as part of the plant records to constitute evidence of acceptability.

B. AGGREGATES

Evidence of acceptability shall be a certification of aggregates document issued by the bituminous concrete Producer providing the following information for all coarse and fine aggregates:

(1) Size

(2) Test Number

(3) Class

(4) Source

When changes in test number and/or the introduction of additional sizes occur, a new certification is issued describing all aggregates physically present for the Department's work including those represented by test numbers originally certified. A copy of each certification shall be maintained in the Inspector's file.

Whenever aggregates are transported to the plants from outside sources, each shipment shall be accompanied by a delivery ticket including the following information:

(1) Name and location of aggregate source.

(2) Nominal aggregate size.

(3) Name and location of supplier if different from aggregate source.

These tickets shall be maintained on file by the Producer subject to Department review at any time.

C. MINERAL FILLER, LIQUIFIER, HYDRATED LIME, GILSONITE, POWDERED ASPHALT

Evidence of acceptability shall consist of the manufacturer's certification that the material conforms to Specifications.

IV. ACCEPTANCE OF PRODUCTION

A. GENERAL

The acceptance of bituminous concrete mix as it is produced at the plant depends upon the assurance that the aggregate gradation and bitumen content is uniform and within Specifications. The procedure for establishing and maintaining the proper gradation and uniformity of aggregate sizes, as well as bitumen content, is the objective of this Section. The necessary action required when test results fall outside the job mix limits is also described.

The gradation of aggregates in the resultant mix is determined by performing an analysis of the aggregates in the hot bins (Hot Bin Analysis Test). The tendency for a mix to remain within the formula limits during the time interval between gradation tests is determined by the percentage of primary sizes in the hot bins (Uniformity Test). Proportioning consistency of the hot bin batch weights and the bitumen content are monitored through an automatic control system and the components of the resultant mix are recorded.

At the option of the Producer, he may have his own personnel run the required tests under close supervision of the Inspector and in complete accordance with these methods. Each test so run shall be subject to the approval of the Inspector. Should the Inspector find any portion of the test procedures unsatisfactory, he shall disregard the results therefrom and rerun the test himself.

1. Aggregate Gradation

A complete gradation test for a bituminous concrete mix is defined as a test that yields results for all specified sizes in the job mix formula. The hot bin analysis shall be used for determining the gradation of all mixes for acceptance purposes with the exception of the material smaller than the #80 and #200 in top mixes. The hot bin analysis results for these sieve sizes are for informational purposes only. The test for determining the acceptance of material smaller than the #80 and #200 sieves is the bitumen extraction test. However, if two consecutive hot bin analyses show results outside of the job mix limits for either of these two sizes, a bitumen extraction test shall be run immediately.

Under routine production, one sample per day of finished mix shall be taken and extracted whenever a mix or mixes with specified gradations including the #80 and #200 sieves are produced. If results obtained from any test are not within the job mix limits, the procedure for returning to acceptable routine production, as described in Section B-2, shall govern.

The details of the above tests are described in Materials Methods 5.2, "HOT BIN ANALYSIS" and 5.4, "BITUMEN EXTRACTION TEST."

2. Uniformity of Aggregate Hot Bins

The tendency of an aggregate gradation to remain within the job mix formula limits consistently depends upon the uniformity of the aggregate in the hot bins. A uniform aggregate gradation is as follows:

(a) Aggregate gradation within the job mix formula limits.

(b) Coarse aggregate hot bins contain a minimum of 70% primary size.

The criteria which the individual hot bins must meet to remain uniform as determined by Materials Method 5.3, "HOT BIN UNIFORMITY," are as follows:

(a) Results of the uniformity tests for all hot bins must be within ± 12% of the value obtained in the last complete hot bin analysis of the same type mix meeting the requirements noted above.

(b) Coarse aggregate hot bins must contain a minimum of 70% primary size.

3. Bitumen Content

The bitumen extraction test indicates the approximate bitumen content. Actual bitumen content is determined by verifying batch quantities. Should the bitumen content, as determined by extraction, fall outside the job mix formula limits for two (2) successive tests, the scale or meter used to proportion the bitumen into the mix shall be checked at the end of that day's production and subsequent production considered acceptable only upon satisfaction of proper scale or meter accuracy.

B. PROCEDURE FOR DETERMINING ACCEPTABLE PRODUCTION

The acceptability of production is based on several factors as indicated in this Materials Method, but the factor which requires closest attention is the aggregate gradation of the mix and uniformity of the hot bins. In order to have full assurance that the desired mixes are obtainable within the job mix formula limits, it is necessary to have information on the capability of a plant to produce each type of mix before any is allowed to be dispatched to State projects. The following Section along with Figure #1 is used to gain such information. However, the District Engineer may waive this requirement when plant and aggregate conditions are substantially the same as they were during the last satisfactory production of the mix involved.

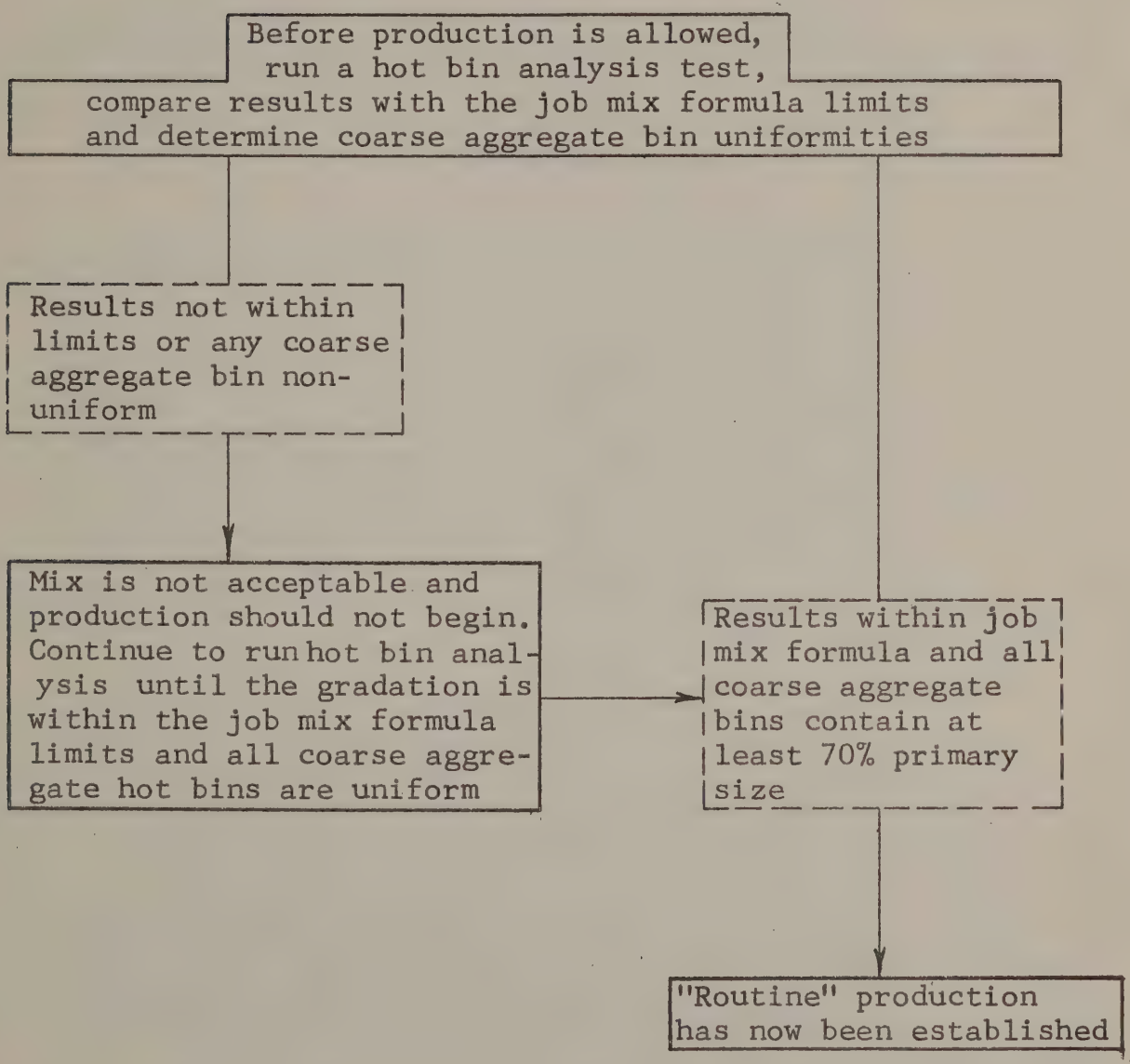
1. Initial Production of Each Mix Type

The following procedure applies to the initial annual production of each mix type by a plant and describes the necessary steps required to determine if the plant is capable of producing a mix within the approved job mix formula limits. Figure #1 is a graphical presentation for the procedure to be followed in this situation.

Before production is allowed, a hot bin analysis test must have been run, found within the job mix formula limits, and each coarse aggregate bin proved uniform by containing at least 70% of the primary size. Should the Producer, upon notification of a gradation outside of the job mix limits, but with all coarse aggregate bins uniform, elect to adjust his batching weights to get back in, he may do so, provided that material has not been drawn from the bins since the samples were taken. If material has been drawn from the bins, a new complete gradation test must be made and found satisfactory before production is acceptable. Once production is approved, "Routine Production", as defined under Section B-2, shall apply; starting with a complete hot bin analysis as the first test run.

FIGURE #1

INITIAL ANNUAL PRODUCTION OF EACH MIX TYPE



2. Routine Production

The purpose of the routine production procedure is to monitor and control the batch-to-batch and day-to-day production of mixes which have previously been proved capable of being produced uniformly. A graphical presentation of routine production is shown in Figure #2.

Providing that the uniformity tests and the hot bin analysis indicate satisfactory gradation, the suggested test frequency is one (1) uniformity test for every 100 batches* and one (1) complete hot bin analysis for every four (4) uniformity tests.

The gradation and uniformity tests shall be performed continuously at the prescribed testing frequency and sequence regardless of the mix type being produced. For example, should a Producer switch from binder to top and the next scheduled test is a uniformity test, the uniformity test would be the first one performed on the top mix. The results of the test would be compared to the ± 12% range as determined from the values of bin uniformities in the last complete hot bin analysis completed on top mix. This comparison for uniformity tests would continue until the testing sequence required a complete hot bin analysis for the top course currently being produced.

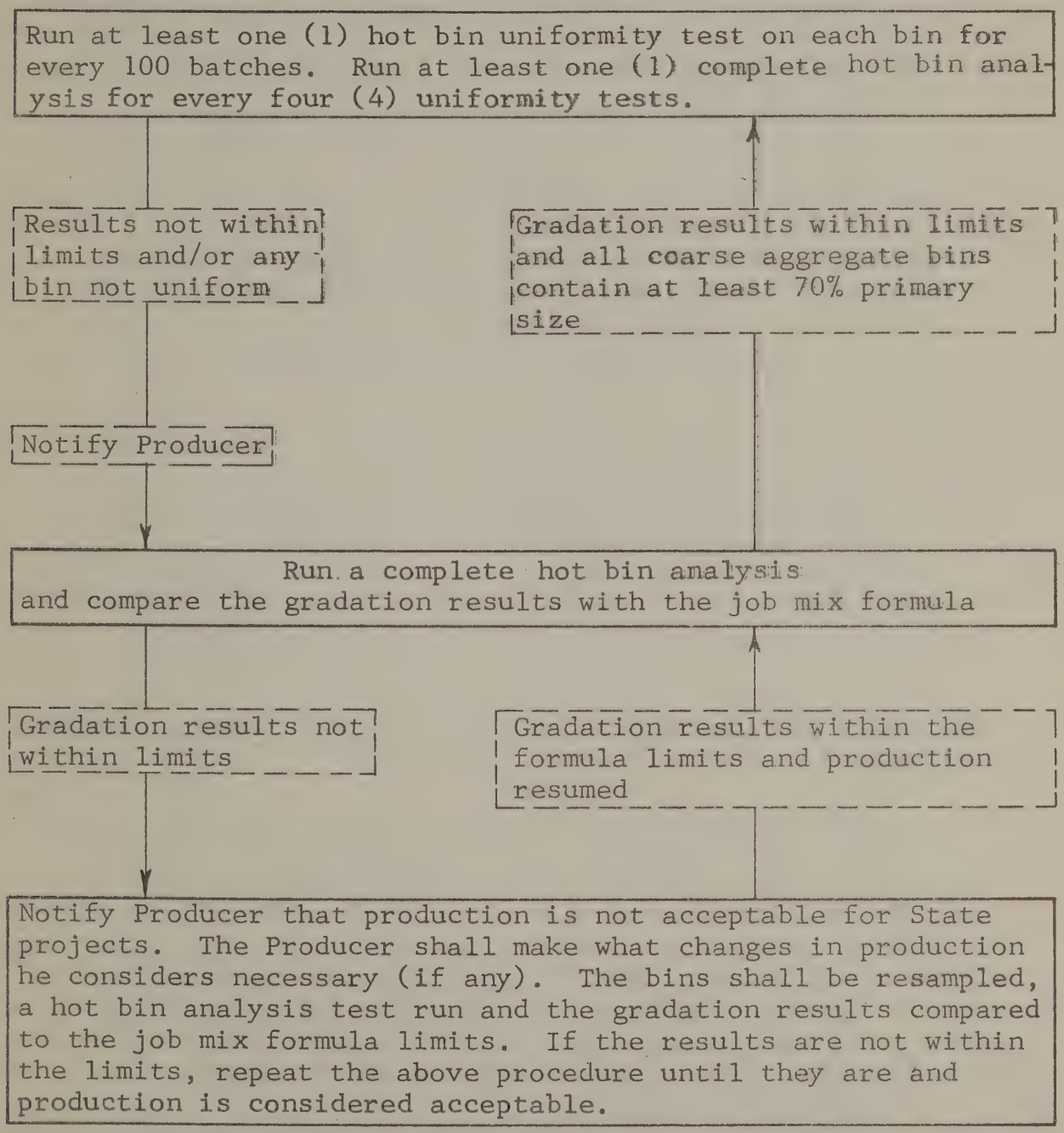
When significant changes are made in the cold feed for the production of a different mix, the Inspector should attempt to sample the hot bins to detect possible influences in bin uniformity and/or gradation as soon as the new aggregate sizes begin entering the mix.

Should any test indicate non-uniformity (as defined in Section A-2) and/or gradation results outside of the job mix limits, the Inspector shall notify the Producer and immediately run a complete hot bin analysis. Upon

* This particular frequency is to be considered as a suggested testing rate. Should individual plant condition dictate a lower routine testing rate, the District Engineer may execute a written directive to the plant Inspector setting a specific minimum testing rate which will then supersede the Materials Method figure.

FIGURE #2

ROUTINE PRODUCTION



NOTE: The testing sequence, frequency and guidelines shall be followed consecutively from point to point in the flow diagram regardless of whether only one mix is produced or production is switched from one type to another.

finding unsatisfactory results from the second test, the Inspector shall notify the Producer that subsequent production is unacceptable. The Producer shall correct the gradation and verify by a complete hot bin analysis. This part of the procedure is also independent of mix type. For example, if the last complete hot bin analysis was outside of the job mix limits for binder mix and the plant then switched to top, a complete hot bin analysis would be run on the top mix. If any results from this sample were outside of the job mix limits, production would be unacceptable. The Producer would make the necessary corrections and verify that the gradation was properly adjusted by a complete hot bin analysis before acceptable production resumes.

C. ACCEPTANCE PROCEDURE FOR BATCH PROPORTIONING

1. Tolerance Controls and Interlocks

Stoppage of production due to the function of the tolerance controls and interlocks, as described in Materials Method 5.1 "INSPECTION OF AUTOMATED BATCH PLANTS" shall be corrected whenever practical in the presence of the Inspector. However, in the absence of the Inspector, the Producer may take necessary action, providing that such action is noted on the recordation for the batch in question and the Inspector is informed at the earliest opportunity. Stoppages shall be corrected in the following manner:

a. The scale or meter shall be observed in order to verify whether or not the quantity is, in fact, outside the allowable delivery tolerances.

b. If the material is within tolerance, the batching may proceed and the tolerance or other control causing the interruption shall be corrected for subsequent batches.

c. If the material is outside of tolerance, the Producer has three (3) options: he may add the same material if the quantity was short; he may subtract the same material if the quantity was too great; or he may discard the batch and start again. In no case shall an increase or reduction of material from the next bin be considered an acceptable means of correcting batching errors.

2. Recordation

Should the total quantity check as described in Part VII Section D of this Method indicate discrepancies or if field performance seems inadequate, a thorough study of the recordation for that day shall be made.

Should any batch not be recorded, it shall be deducted from the total plant output unless it can satisfactorily be accounted for.

In addition, any aggregate size except mineral filler under certain conditions or bitumen which is recorded more than twice the delivery tolerance from its desired amount, the batch shall be rejected. Example: The allowable recorder range for a desired aggregate weight of 1000 lbs. in a 5000 lb. batch would be 1.5% x 2 x 5000 = ± 150 lbs. or 850 lbs. to 1150 lbs. Such rejections shall consist of deductions in the acceptable payment quantities, Form BR-86. If twice the delivery tolerance of mineral filler is less than the acceptable minimum recorder resolution, it shall be assumed that the correct weight of mineral filler was added to the batch by the interlocked automated delivery system. If unsatisfactory pavement performance is evident to the District Engineer, the defective pavement shall be removed and replaced at no cost to the State.

V. INSPECTION OF PLANT EQUIPMENT AND OPERATING PROCEDURES

A. GENERAL

In order to produce a mix consistently within Specifications, a high degree of uniformity of production is required. The Inspector should, in addition to testing, inspect plant equipment and plant operating procedures and have corrected any condition which is not in compliance with the Specifications.

Outlined below are some major items falling within the Inspector's responsibility. Applicable references which describe inspection details are cited and should be referred to when necessary.

B. AGGREGATE STOCKPILES AND HANDLING

The Inspector shall daily observe the stockpiles and the methods used to transport the aggregates to the cold feed. If segregation or degradation is noticed, he shall report this to the Producer. If these conditions are not corrected, the Inspector shall increase the frequency of gradation tests and so notify the District Office.

If there is a significant increase in the moisture content of the cold aggregates, a moisture test of the hot bin aggregates shall be made in accordance with Materials Method 5.7 "AGGREGATE MOISTURE CONTENT TESTS."

C. COLD FEED

The cold feed shall be observed daily and the Inspector shall inform the Producer of any conditions that may tend to reduce the uniformity of the feed (a feed gate clogged, one or more bins almost empty, etc.).

D. DRYER

The dryer exhaust stack shall be periodically observed. If black smoke is discharged from the dryer exhaust, the Inspector shall immediately take a sample of the aggregates feeding from the dryer to the screens, even if this involves stopping plant production. If it should be physically impossible to sample the aggregates at this point, a visual check should be made of the hot bin aggregates for a reasonable period of time (depending on bin size). If the aggregate has an oily coating, it shall not be permitted in State work.

E. DUST COLLECTOR

The operation of the dust collector shall be periodically observed and if not working efficiently, the Inspector shall so notify the Producer and the District Office. When this situation occurs while producing a mix specifying material passing the #80 and #200 sieves, the number of bitumen extraction tests only should be increased to observe the affects of the deficient dust collection system.

F. SCREENS

The plant screens shall be observed periodically for condition and cleanliness. The screens should be inspected for excessive wear or holes if oversize aggregate appears in a bin.

G. HOT BINS

The Inspector shall insure that the hot bin telltale devices are functioning properly and that the bin overflow chutes are not plugged.

H. SCALES, METERS

Aggregate and bitumen scales shall be checked prior to annual production and at least once every 60 days under the supervision of the Inspector. The details of the inspection procedure are described in Materials Method 5.5 "AGGREGATE AND BITUMEN SCALE TESTS."

The scales shall be observed frequently for binding, improper tare and excessive vibration. The Inspector shall also verify that inspections are being made by the Producer's scales technicians.

If bitumen is proportioned by volume, the meter shall be checked for accuracy prior to annual production and at least once every 60 days under the supervision of the Inspector. The details of the appropriate inspection procedure are described in Materials Method 5.6 "BITUMEN METER TESTS."

The Inspector shall observe the meter and insure that the meter pointer is returning to zero. Corrections in the meter settings when changes in bitumen specific gravity or temperatures occur shall also be verified by the Inspector.

I. PROPORTIONING CONTROLS

The Inspector shall frequently observe the operation of the automatic batching controls and insure that the required delivery tolerances are set, the interlocks are functioning properly, and that seal control is being maintained where

necessary. The calibration of the controls shall be checked weekly in detail and spot checked daily. The details of these inspection procedures are described in Materials Method 5.1 "INSPECTION OF AUTOMATED BATCH PLANTS."

J. RECORDING EQUIPMENT

The Inspector shall observe the recorder each morning and insure that the time-date is correct, the batch counter is set properly and that the output is compatible with the scale or meter movement.

The recorder should be checked weekly in detail as prescribed in Materials Method 5.1 "INSPECTION OF AUTOMATED BATCH PLANTS."

K. TEMPERATURE CONTROL

The temperature of the dryer discharge, fine aggregate bin, bituminous feed line and finished mix shall be periodically determined by the Inspector. If the bituminous feed line and/or finished mix deviates from the allowable temperature range specified for pavement items in the Specifications, production for State projects shall be unacceptable until they are corrected. Any finished mix found outside the range shall be rejected. Should substantial deviations between the dryer discharge, fine aggregate bin and/or finished mix temperature, or between tank and line bitumen temperature be noticed, these thermometers shall be checked as soon as possible.

L. MIXING TIME

The Inspector shall observe the mix timers daily and insure that the proper mixing times are set. The dry and wet mixing times are prescribed by the Specifications or may be modified by written permission in accordance with Materials Method 5.10 "MIXING TIME."

M. PUGMILL

At intervals of not longer than two (2) weeks, the Inspector shall inspect the pugmill for signs of paddle

breakage and wear and/or leakage. The pugmill shall be repaired if one or more paddles are broken or worn beyond Specification tolerance before being allowed to produce for State projects.

N. DELIVERY VEHICLES

Prior to receiving the finished mix, each vehicle shall be free from foreign substances including portions of the previous mix and shall be lightly coated with an approved solution. The solution may be a lime water or a release compound approved for asphalt mixes. The District Office maintains a current list of the approved release compounds which is published periodically by the Bureau of Materials. The truck body shall be raised to drain any excess solution prior to loading.

The Inspector shall insure that the load is covered before the delivery vehicle leaves the plant.

VI. SAMPLING PROCEDURES

A. BITUMINOUS MATERIALS

Generally, a sample of bitumen is taken from the sampling valve in the plant lines after each delivery of material. Selected samples are then forwarded to the Bureau of Materials for testing. The details of the sampling procedure are described in Materials Method 8.2 "SAMPLING BITUMINOUS MATERIALS."

B. MIX SAMPLES

One sample per week of each type top course produced that week shall be taken from the truck immediately upon batching and forwarded to the Bureau of Materials to determine the physical properties of the mix. Binder and base course samples are not required by the Bureau.

The method of sampling is described in Materials Method 5.4 "BITUMEN EXTRACTION" except that 2000 grams (approximately 2 quarts) are required from the same location in the batch sampled. A BR-170 shall be completed and the last copy affixed to one of the sample containers and another copy mailed to the Bureau. A completed copy of this form is shown in Figure #3.

FORM BR-170a (1/65)
NEW YORK STATE
DEPT. OF PUBLIC WORKS
BUREAU OF MATERIALS

BITUMEN OR MIX SAMPLE

FOR LAB USE ONLY
TEST NO.
DATE REC'D.
SERIAL NO. 24488

SEE REVERSE SIDE FOR INSTRUCTIONS

PRIMARY SOURCE* —
LOCATION* —

LOT. NO.*	ITEM NO.*†	GRADE TYPE*†	DATE SAMPLED*†	TIME SAMPLED*†
—	51M	1A TOP	6/10/67	9:30 A.M.

SAMPLED BY*†	DISTRICT NO.*†	JOB-MIX FORM. NO.†	TONS REPRESENTED†
J. Bushey	11	2	5,700

COMPLETE THIS SECTION FOR SAMPLES TAKEN AT BITUMINOUS CONCRETE PLANT.

NAME OF OWNER*†: BLACKTOP, INC.
LOCATION*†: SITE, N.Y. (Pugmill #2)
REMARKS*†: 2-1qt. Cans

COMPLETE THIS SECTION FOR SAMPLES TAKEN AT THE PROJECT SITE.

NAME OF SUPPLIER*† —
LOCATION*† —
CONT. OR HM NO.*† —
VEHICLE NO.* —
STATION AND LANE*† —
GALS. REP. AT 60° F.* —

FORMS DISTRIBUTION
1 - BUREAU OF MATERIALS 2 - DISTRICT FILE 3 - PROJECT-ENG. 4 - AFFIX TO SAMPLE CONTAINER

COMPLETE FOR BITUMEN SAMPLE*
COMPLETE FOR MIX SAMPLE†
COMPLETE FOR EITHER TYPE OF SAMPLE*†

FIGURE #3

Mix samples shall be submitted in two (2) - one (1) quart friction top cans packaged in a pre-addressed cardboard box mailer. The sample containers and mailers are available upon request from the Bureau of Materials.

VII. ADMINISTRATIVE PROCEDURES

A. GENERAL

The Inspector is responsible for maintaining a diary, test records, production records and issuing acceptances to projects. A summary of production activities, test results and materials certifications shall be kept on file. Conversations with the Producer and other pertinent information shall be entered daily in a plant diary. All records shall be filed in an orderly fashion so they may be readily consulted.

B. DELIVERY TICKETS

Regardless of the payment of recording system in use, each truckload of bituminous concrete arriving at Department projects must be accompanied by a delivery ticket prepared by the Producer which includes the following minimum information:

1. Delivery ticket number
2. Plant identification
3. Contract number
4. Material - Item number and type
5. Quantity of material in truck
6. Date and time

The plant Inspector shall ensure that delivery vehicles have correct tickets by spot-checking.

C. ACCEPTANCE ISSUE

A quantity acceptance form, BR-86, for material produced and authorized to be shipped to each project shall be completed by the plant Inspector no later than the following day and delivered to the Project Engineer for his project records. This form shall indicate only the quantity of production which is acceptable. A sample of the completed

form, BR-86, is shown in Figure #4.

BR 86B 9-65 — STATE OF NEW YORK — DEPARTMENT OF PUBLIC WORKS — BUREAU OF MATERIALS

Shipped
Shipment Authorization
A. Test Completed ☑
B. Test Pending ☐

Material 1A TOP BIT. CONC. Shipped by BLACKTOP CO.
Lot No. — Location SITE, N.Y.
Consignee PAVING CONTRACTOR Date Shipment Insp. —
Cont. No. RC 67-1 Date Shipped 8/20/67
Destination JOB, N.Y.
Vehicle Type TRUCKS
Vehicle No. —
Quantity 1022 TONS

COMPLETE ONLY WHEN SHIPPED UNDER "A" ABOVE
Test No. —
Accepted for Item No. 51M
Date Accepted 8/20/67

Inspector Joseph Bushey

FIGURE #4

At the discretion of the District Engineer, where plant inspection is not provided, small daily quantities of bituminous concrete required for such items as gutters, driveways, sidewalks and detours may be accepted on the basis of the Producer's written certification that the material conforms to Specifications.

D. PRODUCTION RECORDS

Recordation of the proportioning process is utilized in several different ways, depending upon the truck weighing procedures at the plant and the particular type of recordation available (tape, ticket, graph).

The general procedure consists of reviewing the recordation daily and performing a check between recorded quantities and dispatched quantities. If there are discrepancies in the quantity check, or if there are indications that proportioning has been in error, the recordation shall be reviewed in detail. The results of routine quantity check (See Figure #5) or the detailed review (See Figure #6) shall be recorded on Form BR-188 which is filed initially at the plant, and later in the District Office, with the original copies of the recordation.

At the end of each working day, the Inspector shall identify the batches on the recordation as to mix type and contract number, count the batches, prepare Form BR-188 and file the recordation by date. In order to differentiate deliveries made to different locations on the graph and tape recordings, it may be necessary to mark the recordation at the time of batching or identify the batches by correlating the time or serial number on the delivery ticket to that on the recordation.

The quantity of production from the number of batches for a mix multiplied by the desired (programmed into the batcher presets, punch card, etc.) batch weights should check the total dispatched or invoice quantity as indicated on Table I (See page 5.0-24). When so verified, the quantity shown on the Form BR-86 shall be based on the total invoice quantity. Should the totals differ by more than indicated, the recordation shall be carefully reviewed for completeness and/or proportioning errors. If the difference is due to proportioning errors, adjustments shall be made to the invoice quantity as described in Part IV, Section D.2 of this Material Method.

Table I provides methods for determining Acceptable Quantities and one method agreed upon by the District Engineer and the Producer shall be adhered to daily by the Inspector. The choice of method shall depend upon the particular weighing and recordation system preset at the plant.

REMARKS CONCERNING FIGURE #5

(1) Figure 5 is an example of a routine quantity check made for a plant with a graph recorder where truck weights are used for payment.

(2) Prepare form for each mix on each contract. File one copy with recordation. Other distribution as ordered by the District Engineer.

(3) Time-date or batch serial number (if available) can be used for identification purposes. Batches may be grouped together.

(4) "Batch Size" is the theoretical (programmed) total batch weight.

(5) These columns are used only for a detailed recordation review. (SEE Figure #6)

(6) "Total Batches" as determined by counting batches on the recordation. Take partial batches into account.

(7) "Quantity" is the product of the "Batch Size" and "Total Batches."

(8) "Total Recorded" is total quantity as determined from the recorder.

(9) "Total Dispatched" is taken from Producer's figures. (Should equal total of quantities on delivery tickets)

(10) "Difference" in this example should be within 2% of the recorded quantity. In other cases, the totals may have to check exactly. Explain discrepancies.

(11) "Corrections" may be due to rejections. Explain any corrections.

(12) "Corrected Total" is entered on Form BR-86.

FIGURE #5

DR 108 (3/65)

NEW YORK STATE DEPARTMENT OF PUBLIC WORKS (1) BUREAU OF MATERIALS

BITUMINOUS CONCRETE DAILY PRODUCTION REPORT

DISTRICT 11 SHEET 1 OF 1 REPORT DATE 6/20/67

PLANT XYZ BLACKTOP CO. LOCATION NORTHTOWN, N.Y.

(2) CONTRACT RC 67-23 MIX TYPE 51M - BINDER INSPECTOR Joseph Bushey

RECORDATION REVIEW PAYMENT BY [✓] TRUCK WEIGHTS [ ] BATCH WEIGHTS RECORDER [✓] GRAPH [ ] TAPE [ ] TICKET

(3) IDENTIFICATION	BATCH SIZE (4)	BATCHES IN	BATCHES OUT	BATCHES INCOMPLETE	TOTAL (6) BATCHES	(7) QUANTITY	REMARKS
0730-0845	2T	S	(5)	S	53	106T	
0950-1115	2T				56.5	113T	
1305-1420	2T				54	108T	
TOTALS					163.5	327T	

PRODUCTION SUMMARY

TOTAL DISPATCHED (9) 330.2T

TOTAL RECORDER (8) 327.0T

DIFFERENCE (10) 3.2T

EXPLANATION:

O.K. Difference within 2%

TOTAL DISPATCHED (9) 330.2T

CORRECTIONS (11) NONE

CORRECTED TOTAL (12) 330.2T

EXPLANATION:

COMPLETE DAILY AND FILE ONE COPY WITH RECORDATION

REMARKS CONCERNING FIGURE #6

(1) Figure 6 is an example of a detailed recordation review made for a plant with a tape recorder where theoretical batch weights are used for payment. This detailed review was made because a routine review indicated discrepancies between the total dispatched and the total recorded quantities.

(2) (3) (4) SEE remarks for Figure 5.

(5) "Batches In" is the number of batches within tolerances. Take partial batches into account.

(6) "Batches Out" is the number of batches outside tolerances.

(7) "Batches Incomplete" is the number of batches for which recordation data is incomplete.

(8) "Total Batches" is the total of 5, 6 & 7 above.

(9) "Quantity" is the product of the "Batch Size" and "Total Batches."

(10) Explain "Batches In", "Batches Incomplete", or enter other pertinent information.

(11) "Total Recorded" is total quantity as determined from recorder.

(12) "Total Dispatched" is taken from Producer's figures. (Should equal total of quantities on delivery tickets)

(13) "Difference" in this example should equal zero. In other cases, the 2% criteria may apply. Explain discrepancies.

(14) "Corrections" may be due to rejected batches. Explain any corrections.

(15) "Corrected Total" is entered on Form BR-86.

FIGURE #6

NEW YORK STATE DEPARTMENT OF PUBLIC WORKS BUREAU OF MATERIALS (1)

BITUMINOUS CONCRETE DAILY PRODUCTION REPORT

DISTRICT 11 SHEET 1 OF 1 REPORT DATE 6/13/67

PLANT ABC STONE CO. LOCATION SOUTHVILLE, N.Y.

(2) CONTRACT FARC 67-103 MIX TYPE 455P INSPECTOR Joseph Bushey

RECORDATION REVIEW PAYMENT BY ☐ TRUCK WEIGHTS ☑ BATCH WEIGHTS RECORDER ☐ GRAPH ☑ TAPE ☐ TICKET

(3) IDENTIFICATION	BATCH SIZE (4)	BATCHES IN (5)	BATCHES OUT (6)	(7) BATCHES INCOMPLETE	TOTAL (8) BATCHES	(9) QUANTITY	(10) REMARKS
0-64	5000	62			62	310,000	
23	"		1		1	5,000	#1 Bin out 40# Corrected - O.K.
24	"		1		1	5,000	#1 Bin out 35# Corrected - O.K.
123-180	"	56.5			56.5	282,500	
200-243	"	42			42	210,000	
239	"			0.5	0.5	2,500	Recorded off for part of batch - O.K.
TOTALS		160.5	2	0.5	163	815,000	

PRODUCTION SUMMARY

TOTAL DISPATCHED (12) 820,000

TOTAL RECORDER (11) 815,000

DIFFERENCE (13) 5,000

EXPLANATION:

Checked with Producer - No satisfactory explanation. Batch not recorded or clerical error.

TOTAL DISPATCHED (12) 820,000

CORRECTIONS (14) - 5,000

CORRECTED TOTAL (15) 815,000

EXPLANATION:

Deduct 1-5000# Batch which cannot be accounted for.

COMPLETE DAILY AND FILE ONE COPY WITH RECORDATION

TABLE I

METHODS FOR DETERMINING ACCEPTABLE PRODUCTION QUANTITIES

RECORDATION TYPE	TOTAL DISPATCHED QUANTITY-FORM BR-86	ACCEPTABLE DIFFERENCE	QUANTITY CHECK-FORM BR-188
GRAPH	1. Truck Scale Weight	± 2%	1. Number of batches recorded or accounted for on the recorder multiplied by the programmed batch weight.
	2. Theoretical Weight (Number of batches X programmed batch weight)	0% (Exactly)	
TICKET	1. Imprinted Ticket Weight (Exact Sum of Recorded Weights)	± 2%	
	2. Theoretical Weight (Number of batches X programmed batch weights)	0% (Exactly)	
	3. Truck Scale Weight	± 2%	
TAPE	1. Truck Scale Weights	± 2%	
	2. Imprinted Tape Weight (Exact Sum of Recorded Weights)	± 2%	
	3. Theoretical Weight (Number of batches X programmed batch weights)	0% (Exactly)	
Recording Truck Scale (For Continuous Mix Plants)	1. Truck Scale Weight	0% (Exactly)	1. Sum of imprinted weight on delivery tickets.

NEW YORK STATE
DEPARTMENT OF PUBLIC WORKS
BUREAU OF MATERIALS

"PLANT INSPECTION OF BITUMINOUS CONCRETE"
INSPECTION OF AUTOMATED BATCH PLANTS

I. SCOPE

This method describes the batching controls and recording systems in bituminous mixing plants and prescribes specific procedures for inspection of this equipment during normal periods of operation. Actions to be taken when equipment malfunctions occur are described. The formulation of these procedures has been based upon typical combinations of equipment. Exact inspection practices for each plant should be designed for the particular plant with as close adherence to the principles described herein as possible. Questions concerning the adaptation of this Method to particular conditions should be referred to the Bureau of Materials.

II. GENERAL

The basic requirements for mixing plants as described in the Specifications are detailed in Materials Method 5.8 "PLANT APPROVAL". The plant shall be approved for production for State projects in accordance with the procedures outlined in MM 5.8. It is the Plant Inspector's responsibility to insure that the plant equipment operates to the standards demonstrated at the time of these initial approval inspections.

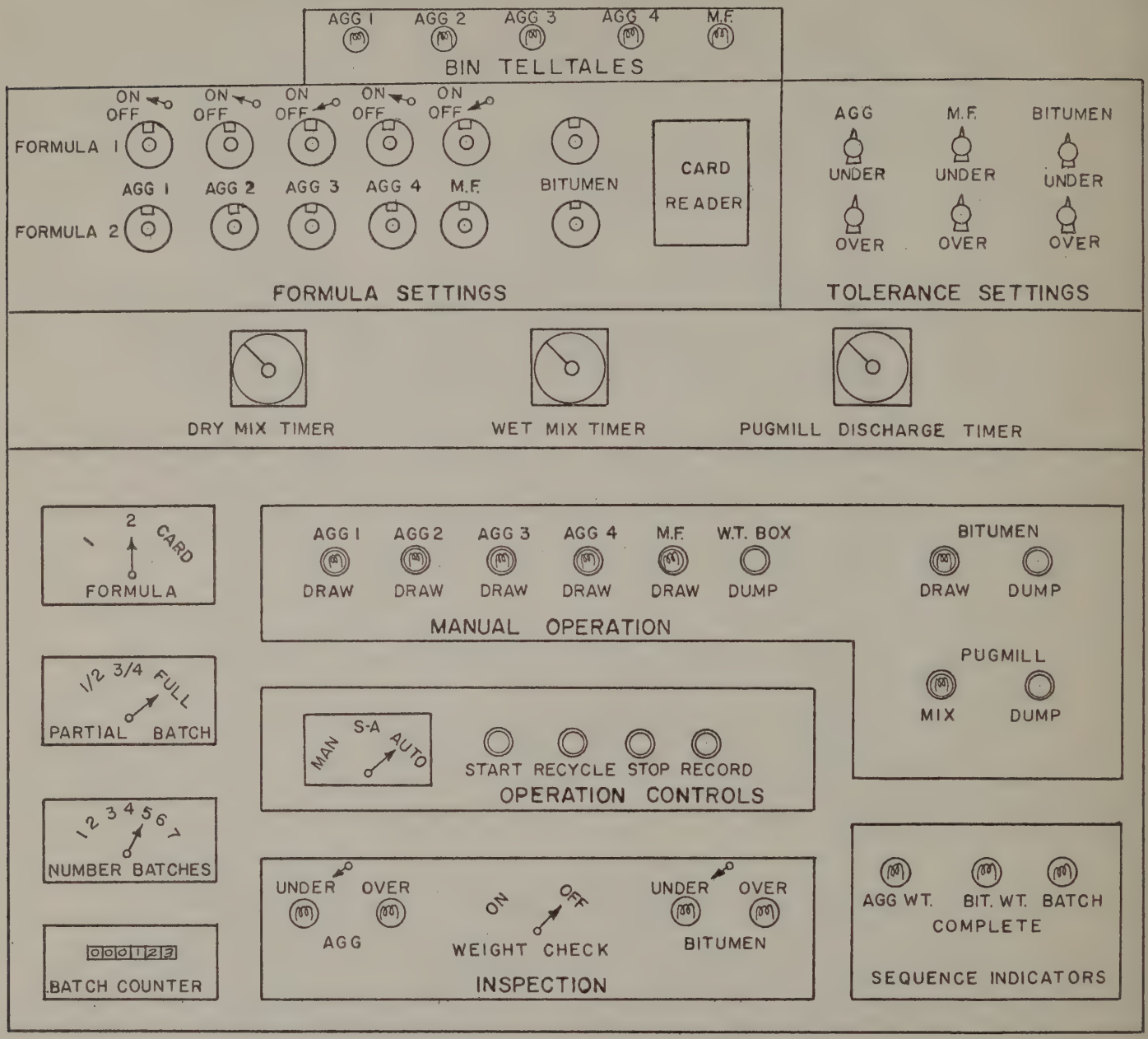
III. AUTOMATION AND RECORDATION EQUIPMENT - BATCH PLANTS

A. GENERAL

The principal components of automation in batch type plants are the aggregate scales, bitumen scales or bitumen meters, the batching controls and recording equipment. Close attention must be paid to their accuracy and adjustment in order to provide trouble-free production. The batching controls automatically draw aggregates and bitumen according to a particular batching formula and the quantities drawn are checked by the tolerance circuits. Whenever an error occurs in batching, there will be an automatic interruption in the cycle until corrective action is taken. The mixing cycle is also automatic and controlled by timers and interlocks. Recordation produces a visual record of quantities of material batched and serves as a check on automatic batching. Recordation also provides necessary documentation for the payment of item quantities.

FIGURE 1

TYPICAL CONTROL PANEL - BATCH PLANT



Key

- Light
- Pushbutton
- Pushbutton with light
- Switch
- Knob
- Preset
- Timer

B. BATCHING CONTROL PANEL - DESCRIPTION AND FUNCTIONS
(See Figure 1 for sketch of a typical control panel. Note that the typical panel described is actually a composite of features from many different systems and no plant should be expected to have a panel with all features described herein.)

1. Preset dials - controls the amount of material required by formula
2. Card reader - reads formula cards
3. Batch plug - controls amount of material required by formula
4. Freefall, chatter - controls the amount of aggregate or bitumen in mid-air suspension which allows more accurate weighing
5. Bin selection switches - controls order of bin draw
6. Tolerance settings - controls tolerance ranges for aggregates and bitumen
7. Dry Mix Timer - controls dry mix period in pugmill
8. Wet Mix Timer - controls wet mix period in pugmill
9. Pugmill Discharge Timer - controls pugmill discharge gate
10. Weigh Box Discharge Timer - controls weigh box discharge gate
11. Formula Selector - allows changing formula when more than one preset is available or when there is a preset, card or batch plug combination
12. Partial Batch Selector - multiplies or divides formula settings to obtain partial batches
13. Number of Batches - sets the number of batches to be batched into a particular truck
14. Batch Counter - totalizes number of batches produced
15. Aggregate and Bitumen Draw Controls - manual controls to draw aggregate and/or bitumen. Lights may be incorporated in these controls that indicate batch progress during automatic batching.
16. Weigh Hopper or Bitumen Bucket Dump - manual controls to dump weigh hopper or bitumen bucket
17. Pugmill Mix, Dump - manual controls to control pugmill
18. Automatic, Semi-Automatic, Manual Control - selects type of batching operation. In "automatic" all operations are automatic; in "semi-automatic" aggregates and bitumen are drawn manually but mixing is controlled by timers and mixing interlocks. In "manual" all operations are controlled manually.
19. Start - master control to start batching operation

20. Recycle - repeats previous cycle after one truck is loaded and another is coming under the pugmill
21. Emergency Stop - stops operation at any time in cycle
22. Record - control toactuate the recorder
23. Sequence Indicators - various lights to indicate when certain batching operations are under way or complete
24. Weight Check - stops cycle at any formula setting during operation so that over-under tolerance controls may be checked
25. Under-Over Lights - indicates whether the weight of a particular aggregate or bitumen is under or over the prescribed tolerance setting

C. FORMULA SETTING

1. Preset-Dial Type

Aggregate weights required from each bin are set on the pre-set dial. These weight settings may be an individual bin draw weight or a cumulative weight. The formula may be set up for a full batch, 1000 pound, or a one-ton batch, depending on the particular system. Bitumen weight or gallonage is set in the same manner.

2. Card System

a. Punch type

Bin draw weights and bitumen weights or gallonage are punched on a card using a hand punch or special card punching device. In some systems, all spaces are punched except those that combine to give the proper weight. The prepared card is then inserted into a card reader on the control panel.

b. Slot type

Slots are cut in a card using a special device and the depth of the slots indicates the weight or percent of material required. The prepared card is then inserted into a card reader on the control panel.

3. Batch Plug System

In this system, a plug consisting of several potentiometers enclosed in a casing is inserted into a receptacle in the control panel. Controls are put in the "calibrate position" and the scales are manipulated manually until the required bin draw weight for the first aggregate is reached. The potentiometer in the plug corresponding to this bin is adjusted with a screwdriver until the "calibration light" goes out. This procedure is followed for all the aggregates and bitumen. Once the batch

plug is calibrated, it can be removed and reinserted at a later time without recalibrating. However, the batch plug should be checked periodically to insure that no changes in calibration have occurred.

4. Other Factors in Setting Formulas

a. Bin Sequence Selectors

Bin batching sequences are set in several ways. In some systems, the order of batching is fixed internally and cannot be changed. Individual bins can be eliminated from batching by the use of "on, off" switches.

In some systems, the batching sequence and/or elimination of bins is set on the formula card.

In other systems, there are separate bin selection controls and these can be set to allow for any desired sequence.

b. Controls for Material in Suspension

All systems have controls to allow for material in mid-air suspension. These are called "freefall", "chatter" or "suspension compensators". These controls slow down or prematurely stop the draw of aggregate or bitumen so the amount of falling material is compensated for in weighing. These controls are adjusted by trial and error.

c. Multiple Systems

Some systems have a combination of card, preset and/or batch plug formula settings. When there are alternate methods of setting formulas, the card or batch plug system should be used in preference to the presets.

d. Bitumen Meters

(1) Meters Without a Temperature Compensator

These meters deliver bitumen in gallons and no internal corrections are made for temperature.

The gallonage required by a particular job mix formula is determined as illustrated in the following example:

Given: Total Batch Size = 4000 lbs.
Percent Asphalt = 5.0%
Weight Asphalt = 0.05 X 4000 = 200 lbs.
Asphalt Temperature = 300°F
Asphalt Specific Gravity = 1.02 @ 60°F
Find: Asphalt Gallons @ 300°F
Solution I: Using a Hetherington and Berner Fluidometer Calculator

Gal. Asphalt = 200 lb. X 0.128 (factor) = 25.6 gal.

Solution II: Using Table 1 in Materials Method 5.9 "BITUMEN METER TESTS"

$$\text{Gal. Asphalt @ } 300^{\circ} = \frac{200 \text{ lb.}}{7.804 \text{ lb/gal}} = 25.6 \text{ gal.}$$

Once the gallonage is determined, the amount (25.6 gal. in the example) is used in the formula setting. It is necessary to change this setting when a change in bitumen temperature or specific gravity occurs.

(2) Meters With an Internal Temperature Compensator

These meters deliver bitumen in gallons at 60°F. Whenever a change in bitumen temperature occurs, the meter adjusts the flow automatically. The meter pointer will indicate 60°F gallons and will not change when temperature changes.

One type of temperature compensator has an adjustment for coefficient of expansion. For paving grade asphalts, this setting should be 0.00035± .

The gallonage required by a particular job mix formula is determined as illustrated in the following example:

Given: Total Batch Size = 4000 lb.
Percent Asphalt = 5.0%
Weight Asphalt = 0.05 X 4000 = 200 lb.
Asphalt Specific Gravity = 1.02 @ 60°F
Find: Asphalt Gallons @ 60°F
Solution: Using Table 1 in Materials Method 5.9 "BITUMEN METER TESTS"

$$\text{Gal. Asphalt @ } 60^{\circ}\text{F} = \frac{200 \text{ lb.}}{8.495 \text{ lb/gal}} = 23.6 \text{ gal.}$$

Once the gallonage is determined, the amount (23.6 gal. in the example) is used in the formula setting. It is necessary to change this setting when a change in bitumen specific gravity occurs.

D. TOLERANCES - SETTING AND INSPECTION

1. Explanation of Tolerances

Aggregate, mineral filler and bitumen delivery tolerances are specified in the Specifications. These tolerances are applied to each batching formula and acceptable ranges for weighing are determined. The batching controls are adjusted to reflect these tolerances so the interlocks will interrupt batching whenever the weight is out of the acceptable range.

The determination of tolerances is illustrated in the following example:

Total Batch Size = 4000 lb.
Aggregate Tolerance = 4000 X 1.5% = ± 60 lb.
Mineral Filler Tolerance = 4000 X 0.5% = ± 20 lb.
Bitumen Tolerance = 4000 X 0.1% = ± 4 lb.

Material	Cumulative Weight	Tolerance	Acceptable Range
Agg. 1	1000	±60	940 - 1060
Agg. 2	2000	±60	1940 - 2060
Agg. 3	3000	±60	2940 - 3060
Agg. 4	3600	±20	3580 - 3620
Filler	3750	±20	3730 - 3770
Bitumen	250	± 4	246 - 254

The zero tolerance for aggregate scales shall be 0.5 percent of the minimum total batch size. For bitumen scales and meters the zero tolerance shall be 0.1 percent of the minimum total batch size.

When mineral filler is used, the aggregate batched before the filler shall have the same delivery tolerance as the filler.

When a portion of total batch size is batched, the tolerances shall be reduced proportionately.

If a meter is used to deliver bitumen, the tolerance in pounds can be converted to a tolerance in gallons.

In no case shall the total weight of the batch vary more than plus or minus 2 percent of the theoretical design weight.

2. Tolerance Settings

All approved systems have tolerance setting controls. However, the manner in which these are set vary considerably. Some systems have separate controls for "under tolerances" and "over tolerances" on aggregate, mineral filler (and the aggregate prior to filler) and bitumen. Some systems have "under" and "over" tolerances on aggregate and asphalt with no separate mineral filler control. Most systems have separate zero tolerance settings for aggregate scales and bitumen scales and/or meters.

All tolerance controls have calibrated dials and each division on the dial usually represents a number of pounds or gallons.

When the plant is producing material for State projects, the Inspector should determine the tolerances and inspect the setting of the tolerances in the controls. Once these initial settings are made, the tolerance circuits should be checked by the Inspector as outlined in the following subsection "Inspection of Tolerance Settings".

It should be noted that when a control system does not have a separate tolerance setting for filler and a mix with filler is being produced, all the aggregate must be batched to a tolerance of ±0.5 percent.

3. Inspection of Tolerance Settings

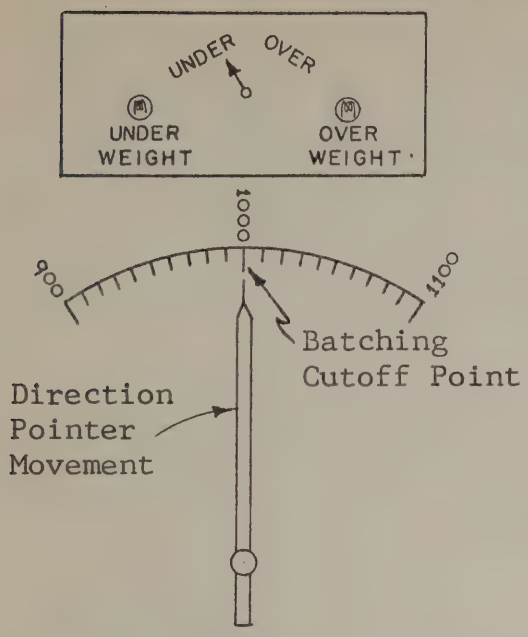
a. Initial Calibration (See Figure 2)

Once the tolerances have been set, it is necessary to inspect them and to make final adjustments if required. The detailed check outlined here should be performed prior to State production and at least once a week during production.

This tolerance check is performed by simulating batching operations and observing where each batching, underweight, overweight and zero cutoff point occurs. The scale dial pointer in the case of aggregate and weighed bitumen is advanced by the use of a device which applies pressure to one of the scale levers. These devices which are usually some type of threaded bolt have been installed by the majority of automated plants. If this device or a similar one has not been installed, the scale dial face can be removed and the pointer can be moved by hand. The pointer should never be moved manually when other means are available. Regardless of the manner in which batching is simulated, this checking operation should be performed carefully and accurately in order to eliminate operational problems.

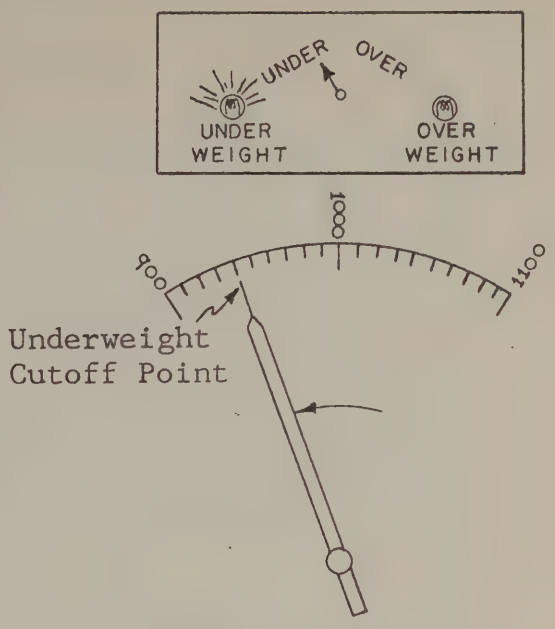
FIGURE 2

TOLERANCE SETTING INSPECTION



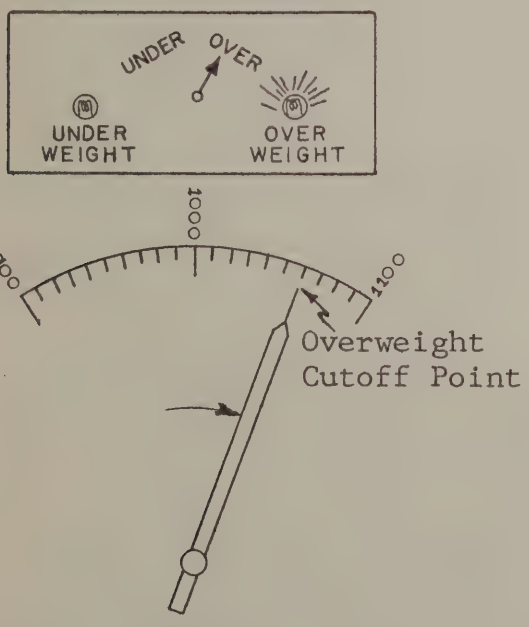
Step 1

Place inspection switch in "under" position. Advance pointer slowly to batching point until "under" light goes out. This is the batching cutoff point. *



Step 2

With switch in "under" position, move pointer slowly down scale until "under" light comes on. This is the underweight cutoff point.



Step 3

Place switch in "over" position and advance pointer slowly until "over" weight light comes on. This is the overweight cutoff point.

Step 4

Place switch in "under" and advance pointer to the next batching cutoff point and repeat steps 1, 2, 3 and 4 until check is complete.

Step 5

Move pointer slowly down scale and determine the zero cutoff point (zero interlock).

* In some systems, it may not be possible to determine the batching cutoff point unless the over and under tolerances are set at zero.

The details of the inspection procedure will vary from system to system and the Inspector will have to know "his" system in order to apply the general procedure outlined below.

The tolerance inspection of a typical system is outlined in detail in Figure 2. This procedure applies to both aggregate and bitumen scales.

The underweight and overweight cutoff points should be within one scale division of that required. It may be necessary to readjust the tolerance settings in order to meet the requirements outlined previously.

When a plant has a bitumen meter, the tolerance check can usually be performed in a manner similar to that outlined for scales. In many systems, the pointer on the bitumen meter is similar to a scale pointer and the underweight and overweight circuits apply in the same way.

b. Inspection During Operation

On most systems, it is possible to stop the automatic batching operation at any batching point. When the scale pointer comes to rest, the Inspector can check whether or not it is within tolerance. Usually the underweight and overweight cutoff points can also be checked at this time.

Another way to inspect tolerance settings during batching operations is to observe the recorder output. Recordation is described in detail in another portion of this Method.

4. Batching Interlocks

In all systems, there are circuits which stop the batching sequence whenever an error in weighing occurs or when a hot bin becomes empty. Generally, these interlocks function only when the plant is operating automatically.

The interlocks can be checked by observing whether or not batching continues when the scale pointer is outside the acceptable weight range for a particular bin. This can generally be accomplished by holding the scale pointer under or above the tolerance cutoff points during the tolerance check procedure and at the same time, attempting to continue the batching cycle.

If an error in weighing occurs during operation and the interlocks stop the batching, it is usually necessary to switch the controls to manual in order to continue.

E. MIXING TIMERS AND INTERLOCKS

The requirements for the functions of mixing timers and interlocks are described in the Specifications. In an automatic plant, this device is usually incorporated in the control panel. The dry mix period is set on the dry mix timer and the wet mix period is set on the wet mix timer.

There may be timers for pugmill discharge time and weigh box discharge time. These timers are set on a trial-and error basis by the Producer. The Inspector should determine that these timers are set in such a manner that all the material discharges from the weigh box and pugmill.

F. RECORDATION

1. General

The purpose of recordation equipment is to provide the Department with a visual record of the material incorporated in projects. These records document the quantity of the produced material and provide a basis for payment.

The recording equipment is electrically connected to the plant scales, meters and batching controls and this equipment monitors the batching operation and produces a visual record of these operations.

The producer has several options in regard to recordation equipment. These options are the graphic strip chart recorder, digital printed tape, and digital printed ticket. The various types of recording equipment are discussed below.

2. Graphic - Strip Chart

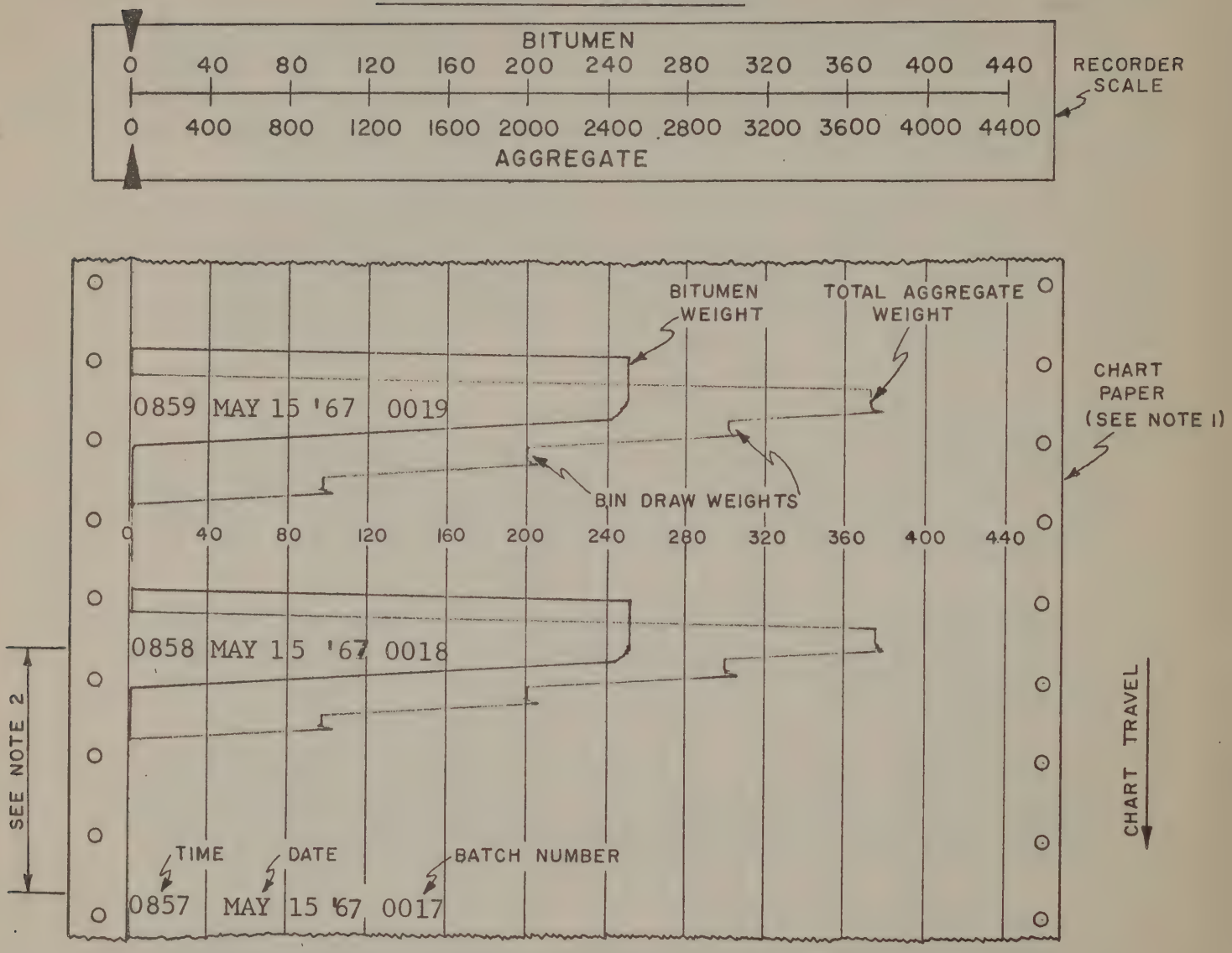
The strip chart recorder records aggregate and bitumen weights by the use of moving pens that record scale pointer movement on a moving chart. On most strip charts, there are two moving pens, one for aggregate and the other for bitumen. In some systems, the bitumen temperature is recorded by a third pen.

Figure 3 is an illustration of a typical strip chart trace. From the trace, the following information can be determined:

1. Individual bin draw weights
2. Total aggregate weight
3. Total bitumen quantity (weight or gallons)
4. Time-date for each batch
5. Batch serial number (optional)

FIGURE 3

STRIP CHART RECORDATION



NOTES:
1. The chart paper generally has a continuous background print of twenty (20) lines per inch.
2. The time-date and batch number stamp for a particular batch is a distance of 3 inches ± below the batch trace.

The recorder should be inspected at the same time the tolerance checks are performed. The strip chart recorder is checked by holding the scale pointer at several points (zero, 1/4, 1/2, 3/4 and full range) on the dial and observing the position of the pen. The pen should be within one half a division of the proper line on the chart paper. It is possible to make adjustments in the recorder if they are required.

3. Digital - Tape

The digital tape recorder prints batching information on a continuous tape through the use of a printing calculator.

Figure 4 is an illustration of a typical printed tape.

1. Zero weights on the aggregate and bitumen scales.
2. Aggregate identification and amount of each aggregate batched.
3. Bitumen quantity
4. Total batch weight
5. Time and date of the batch
6. Batch serial number (optional)
7. Mix identification number (optional)
8. Total weight for each truck load (optional)

The digital tape recorder should be checked at the same time the tolerance check is performed. This can be accomplished by holding the scale pointer at several points on the dial and manually causing the recorder to print. The weight indicated by the pointer and the weight printed should agree within one scale division.

4. Digital - Printed Ticket

The digital printed ticket recorder prints batching information on a truck delivery ticket through the use of a printing calculator. The ticket is a manifold form and one ticket or set of copies is used to record the material batched into one truck.

Figure 5 is an illustration of a typical printed truck ticket.

The following batching information can be determined from the printed ticket:

1. Aggregate identification and amount of each aggregate batched per batch
2. Bitumen quantity per batch
3. Total batch weights
4. Time and date of the load

PRINTED TAPE RECORDATION

AGG ZERO	00	← SCALE ZERO WEIGHT
BIT ZERO	00	
AGG 1	1000	
AGG 2	2000	← CUMULATIVE AGG. WEIGHT
AGG 3	3500	
AGG 4	4200	
M.F.	4539	
BITUMEN	481	← BITUMEN WEIGHT
TOTAL	5020	← TOTAL BATCH WEIGHT
TIME → 0851		
DATE → MAY 15, 1967	1125	← BATCH NUMBER
MIX IDENTIFICATION → MIX 2		

FIGURE 4

TRUCK TICKET RECORDATION

Delivery Ticket Number 00123

ABC PAVING PRODUCTS

Charge To: XYZ CONTRACTORS

Deliver To: RC65-1 NORTHTOWN-PARKVILLE, PT. 1

Material: ITEM 51M BINDER COURSE

Driver: J. JONES Truck Number: 14

Date Time	AGG1	AGG2	AGG3	AGG4	Filler	Bitumen	Total
Sept. 21,1966	1050	1970	3045	4680	0	309	4989
0839	1045	1930	3040	4675	0	310	9974
	1050	1915	3060	4685	0	308	14967
	1055	1985	3075	4675	0	309	19951 ← TRUCK TOTAL
Mix 2							

Truck Arrived	Truck Departed	
_____ AM	8 45 AM	Customer Sign Here
_____ PM	_____ PM	Driver Sign Here

FIGURE 5

5. Batch serial number (optional)
6. Mix identification number (optional)
7. Total weight for the truck (optional)

The digital ticket printer should be checked at the same time the tolerance check is performed. This can be accomplished by holding the scale pointer at several points on the dial and manually causing the recorder to print. The weight indicated by the pointer and the weight printed should agree within one scale division.

IV. EQUIPMENT MALFUNCTIONS AND BREAKDOWNS

A. GENERAL

The Specifications provide for equipment failures and the plant may be allowed to provide material for a 48-hour period if approved by the Engineer. The Producer must have written permission from the District Engineer to operate longer than 48 hours without automation and/or recordation.

There may be many instances in which only portions of the batching or recordation equipment will not operate properly. It is the Inspector's duty to determine the seriousness of the trouble and if possible, take steps to correct the problem. If corrective action cannot be taken, the Inspector should notify the District Office immediately for instructions.

The Inspector should notify the Producer of any equipment malfunctions so corrective measures can be taken.

B. SOME OPERATIONAL PROBLEMS AND CORRECTIVE ACTION

Problem		Action
1. Draw weights incorrect	-	Check formula settings
2. Draw weights incorrect, Formula setting correct	-	Use alternate formula setting (e.g. presets instead of card) Check scales for binding
3. Draw weights out of tolerance, Batching not automatically stopped by interlocks	-	Stop production, check tolerance settings and interlocks
4. Draw weights in tolerance, Batching stopped frequently by interlocks	-	Check tolerance settings and interlocks. Have Producer check "material in suspension" controls

Problem		Action
5. Scale pointer not returning to tolerance of zero. Batching continues	-	Stop production, check zero tolerance and interlock, check for material caught in weigh hopper
6. Scale pointer returns to zero, batching stopped by zero interlock	-	Check zero tolerance and interlock
7. Scale pointer vibration causes interlocks to stop batching frequently	-	Allow an increase in scale dampening to the sensitivity limit allowed by the Specifications (See Materials Method 5.5 "AGGREGATE AND BITUMEN SCALE TESTS")
8. Truck weights outside of ±2% weight tolerance, Automation and recordation satisfactory	-	Stop production, Check aggregate scale and bitumen scale or meter (See Materials Method 5.5 "AGGREGATE AND BITUMEN SCALE TESTS" and 5.6 "BITUMEN METER TESTS")
9. Mechanical or electrical equipment malfunction or failure	-	Stop production, notify Producer and attempt to determine the cause of malfunction or failure. Notify District Office.

V. SEAL CONTROL

An automatic plant with interlocking tolerance controls in proper operation will cause an interruption in the cycle whenever an error in batching occurs. Since this stoppage may be eliminated on many plants by a mere flip of a switch or simple manipulation of the scales, seal control over these elements may be necessary. As each plant will have a different combination of controls, it shall be the responsibility of the District Office and the Plant Inspector to insure that the interlock system will not be bypassed without the knowledge of

the Inspector. The use of seals should depend on the individual plant conditions and the batching control features.

In general, the following controls and switches, if present on the panel, may have to be sealed during batching operations for State projects:

1. Tolerance controls
2. Tolerance "accept" switch
3. Order of bin batching controls
4. The preset dials; if these control the operation
5. The system and/or mix select switch if cards or batch plugs control the operation and presets are available
6. Dry and wet mix timers
7. Any other control as directed by the District Office

Initial approval by the Bureau of Materials requires that all scale levers, rods, pulls and other accessories which may be used to manually manipulate the scales be adequately screened so that any access may be sealed on those plants using digital recordation. This requirement will also apply to any other type plant at the option of the District Office.

Generally seals should be broken only in the presence of the Inspector; however, in his absence the Producer may take action which requires breaking a seal, provided that the Inspector is notified as soon as practical. Should a State seal placed on the proportioning equipment be broken without the knowledge and/or consent of the Inspector, production shall be unacceptable until he verifies all prior batches by careful scrutiny of the recorded proportions.

NEW YORK STATE
DEPARTMENT OF PUBLIC WORKS
BUREAU OF MATERIALS

"PLANT INSPECTION OF BITUMINOUS CONCRETE"
HOT BIN ANALYSIS

I. SCOPE

This method describes specific methods of sampling aggregates from individual hot bins, determining the gradations thereof, and computing the combined gradation of the mix using the actual mixing plant batch weights. Determination of total percent passing the #80 and #200 sieves by this method is approximate and such results are to be used only in conjunction with extraction test results as a guide to plant adjustments.

II. SAMPLING

Representative aggregate samples shall be obtained from individual bins for any selected batch by means of an approved sampling device. The minimum sample sizes required from the hot bins and the minimum size samples for sieving are shown in Table 1.

TABLE I

AGGREGATE SAMPLE SIZE

Aggregate Designation	Nominal Maximum Aggregate Size	Minimum Size Hot Bin Sample	Minimum Size Sample for Sieving
#3	2"	20 lbs.	20 lbs.
#2	1"	20 lbs.	20 lbs.
#1	1/2"	10 lbs.	10 lbs.
#1A	1/4"	10 lbs.	5 lbs.
#1B, Sand	1/8"	5 lbs.	1½ lbs. (700 grs.)

When the sample taken from the bin is larger than that required for sieving, the sample may be split, preferably by means of a sample splitter. In no case shall a predetermined sample size be weighed out from the bin sample without splitting.

If a sample splitter is not available, the following method for quartering shall be used:

1. Distribute a shovelful of the aggregate as uniformly as possible over a wide, flat area on a tightweave canvas, or other smooth surface. Continue to distribute shovelfuls of materials in layers until all the sample is used to make a wide, flat pile that is reasonably uniform in thickness and distribution of aggregate sizes. Do not permit coning of the aggregate.

2. Divide the pile cleanly into equal quarters with a flat-ended shovel, or straight piece of sheet metal. When a canvas is used, the division may be conveniently made by inserting a thin stick, or rod, under the canvas and raising it to divide the sample equally, first into halves, then into quarters.

3. Remove two opposite quarters and set aside.

4. Repeat the foregoing procedure with the remaining portion of the aggregate until a test sample of desired size is obtained.

III. TESTING

The sample shall be separated into the specified coarse aggregate sizes (after it is weighed as a check of the subsequent computations) by sieving it through the coarse aggregate sieves until aggregate no longer falls from one sieve to the next. Care must be taken so as not to overload the sieves. As a rough guide, any coarse aggregate sieve loaded with much more than a single layer of aggregate at the end of the test may be considered overloaded. When overloading occurs, it will be necessary to sieve only portions of the sample at a time, adding the results to obtain the total sample gradation.

For mix gradations specifying sieves smaller than 1/8", the material left in the pan under the coarse aggregate sieves shall be separated into the specified fine aggregate sizes by operating the mechanical sieve shaker for a period of at least 5 minutes.* The fine bin sample shall be sieved for a minimum

*If several test results indicate that a negligible or constant amount of minus 1/8" material remains from the coarse aggregate, this part of the test may be deleted.

of 10 minutes. Care must be taken so as not to overload the 8 inch diameter fine aggregate sieves. As a guide, when the #80 and/or the #200 sieves are loaded in excess of 200 grams and/or any of the remaining sieves retain more than approximately 300 grams of material at the end of the test, the sieves shall be considered overloaded. When overloading occurs, it will be necessary to sieve only portions of the sample at a time, adding the results to obtain the total gradation. Scalping sieves may be introduced into the nest of sieves above the critical sizes as another method to prevent an overloaded condition.

IV. CALCULATIONS

The computations of the combined gradations from the individual bins and the actual mixing plant batch weights are illustrated by examples of a mix with no specified fine aggregate sizes (base or binder) and a mix with specified fine aggregate sizes (top).

A. BASE AND BINDER MIXES

A two-ton plant is producing Item 51M (binder) and the necessary calculations are illustrated in Figure 1. The batch weights used are as follows:

#2 Bin	1840 lbs.
#1 Bin	960 lbs.
1A Bin	440 lbs.
Fine Bin	588 lbs.
Bitumen	172 lbs.
Total Batch	4000 lbs.

Step 1

The sieve separated weights are recorded in the Wt. column of the bin breakdown table and expressed as percentages of the total sieved weight of a bin sample in the "% Ret." column.

$$\text{No. 2 Bin, \% Pass. 1", Ret. on } \tfrac{1}{2}\text{"} = \frac{10.70}{11.15} \times 100 = 95.9\%$$

Step 2

The results in the "% Pass." column are obtained by adding the figures recorded in the "% Ret." column from the smallest sieve upwards to the largest.

No. 2 Bin, % Pass 1/8" = 0.2%
% Pass 1/4" = 0.2 + 0.1 = 0.3%
% Pass 1/2" = 0.3 + 3.8 = 4.1%
% Pass 1" = 4.1 + 95.9 = 100.0% (1)

Step 3

The batch weights are recorded on the combined mix table and converted to percentages of the total aggregate batch weight (% Batched from Bin 2 = $\frac{1840}{3828}$ X 100 = 48.0%)

Step 4

The percent passing gradations from any bin are multiplied by the percentage batched from that bin and recorded in the combined mix table under the appropriate passing sieve. (% Passing ½" sieve from Bin #2 = 4.1 X 0.481 = 2.0%)

Step 5

The figures from Step 4 are added for each passing sieve column to obtain the combined mix gradation and the results compared with the job mix formula. (% passing ½" sieve = 2.0 + 24.3 + 11.5 + 15.4 = 53.2%, job mix formula allows 44%-56% O.K.) (2)

Step 6

The weight of asphalt cement is expressed as a percentage of the total batch weight and compared with the job mix formula. (% A.C. = $\frac{172}{4000}$ X 100 = 4.3%, job mix formula allows 4.0 - 4.8 OK)

(1) Note that the percent passing the top sieve may sometimes only come within one or two tenths of 100.0%. This is usually due to a combination of slide rule accuracy and rounding of figures. As this error is too small to affect subsequent computations, it may be neglected as shown in the table for Bin No. 1.

(2) It should be noted that the aggregate job mix tolerances are expressed to the nearest whole percent. Therefore, in determining whether or not a gradation is acceptable, the combined results are to be rounded off to the nearest whole percent. Accordingly, if the % passing the ½" sieve was 44.5, 44.6 etc., it would be rounded to 45%. If the percentage was 55.4, 55.3 etc., it would be rounded to 55%.

Form BR-161(4/63)

FIGURE 1

STATE OF NEW YORK — DEPARTMENT OF PUBLIC WORKS — BUREAU OF MATERIALS

HOT BIN ANALYSIS

PLANT XYZ BLACKTOP CO. PARKVILLE, N.Y. INSPECTOR Joseph Bushey DATE 6/10/67

ITEM NO. 5M MIX TYPE BINDER AGGREGATE TEMP. 245 °F BITUMEN TEMP, 300 °F

BIN BREAKDOWN

Sieve Sizes	No 2			No. 1			No. 1A			No. 1B			FINES			MINERAL FILLER		
	Wt.	% ret.	% pass	Wt.	% ret.	% pass	Wt.	% ret.	% pass	Wt.	% ret.	% pass	Wt.	% ret.	% pass	Wt.	% ret.	% pass
2"																		
1-1/2"																		
1"	0.00	0.0	100.0	0.00	0.0	100.0	0	0.0	100.0	0	0.0	100.0						
1/2"	10.70	95.9*	4.1	0.33	3.1	97.0	0	0.0	100.0	0	0.0	100.0						
1/4"	0.42	3.8	0.3	9.92	92.5*	4.4	0.87	13.4	86.6	0	0.0	100.0						
1/8"	0.01	0.1	0.2	0.26	2.4	2.0	5.16	79.7*	6.9	60	10.0	90.0						
20																		
40																		
80																		
200																		
PAN	0.02	0.2		0.21	2.0		0.45	6.9		540	90.0							
Totals	11.15			10.72			6.48			600gms								

*% PRIMARY SIZE (UNIFORMITY)

COMBINED GRADATION

BIN	lbs batched	% batched	% Passing Sieve 2"	1-1/2"	1"	1/2"	1/4"	1/8	20	40	80	200
2	1840	48.0			48.0	2.0	0.1	0.1				
1	960	25.1			25.1	24.3	1.1	0.5				
1A	440	11.5			11.5	11.5	10.0	0.8				
1B	588	15.4			15.4	15.4	15.4	13.8				
FINES												
Min. Filler												
TOTAL	3828				100.0	53.2	26.6	15.2				
JOB MIX LIMITS					90/100	44/56	21/29	12/18				

Lbs. Bitumen Batched 172

% BITUMEN 4.3

JOB MIX LIMITS 4.0 - 4.8

MM 5.2 Apr. '67

5.2-5

B. TOP MIXES

A two and one-half (2½) ton plant is producing Item 51M (Top). The method for computing the combined gradation is the same as described in the preceeding section except that the material left in the pan under the coarse aggregate sieves shall be accounted for on the proper sieve sizes smaller than 1/8".

No. 1 Bin - The amount of material left in the pan from this bin is usually small or negligible. If the percentage remains constant and the results from previous tests show that the sizes are always the same, the test on this portion may be deleted and a visual check can be used for succeeding tests. In this example (Figure #2), the size was assumed to be minus #200.

No. 1A Bin - The amount of material left in the pan from the 1A coarse aggregate bin varies considerably from plant to plant. It shall be necessary to sieve the minus 1/8 inch material left in the pan on the 8" diameter fine aggregate sieves and weigh the retained weights in grams. The weight in grams shall than be converted to weight retained in pounds to complete the gradation computations. The conversion factor is 453.6 grams per pound.

In the example (Figure #2), after the minus 1/8" material in the pan was sieved, weighed and found to be 155 grams retained on the #20 sieve, this was converted to weight in pounds by

$$\frac{155}{453.6} = 0.34 \text{ pounds}$$

Mineral Filler Bin - When mineral filler is added to the weigh hopper as a separate and cold addition, the mineral filler shall be considered 100% passing the #200 sieve unless the gradation of the material is known.

FIGURE 2

Form BR-161(4/63) STATE OF NEW YORK — DEPARTMENT OF PUBLIC WORKS — BUREAU OF MATERIALS

HOT BIN ANALYSIS

PLANT XYZ BLACKTOP CO. PARKVILLE, N.Y. INSPECTOR Joseph Bushey DATE 618167

ITEM NO. 5IM MIX TYPE 1A TOP AGGREGATE TEMP. 290 °F BITUMEN TEMP, 300 °F

BIN BREAKDOWN

Sieve Sizes	No. 2			No. 1			No. 1A			No. 1B			FINES			MINERAL FILLER		
	Wt.	% ret.	% pass	Wt.	% ret.	% pass	Wt.	% ret.	% pass	Wt.	% ret.	% pass	Wt.	% ret.	% pass	Wt.	% ret.	% pass
2"																		
1-1/2"																		
1"				0.00		100.0	0.00	0.0	100.0				0		100.0			100.0
1/2"				0.11	0.9	99.1	0.00	0.0	100.0				0		100.0			100.0
1/4"				10.63	93.5*	5.6	043	7.7	92.3				0		100.0			100.0
1/8"				0.61	5.4	0.2	4.78	85.6*	7.7				37	5.4	94.6			100.0
20				0.00	0.0	0.2	1559 / 0.34	6.1	0.6				294	42.4*	52.2			100.0
40				0.00	0.0	0.2	5g / 0.01	0.2	0.4				169	24.4	27.8			100.0
80				0.00	0.0	0.2	0 / 0.0	0.0	0.4				124	17.9	9.9			100.0
200				0.00	0.0	0.2	0 / 0.0	0.0	0.4				57	8.2	1.7			100.0
PAN				0.02	0.2		109 / 0.02	0.4					12	1.7				
Totals				11.37			5.58						693gr					

* % PRIMARY SIZE (UNIFORMITY)

COMBINED GRADATION

BIN	lbs batched	% batched	% Passing Sieve 2"	1-1/2"	1"	1/2"	1/4"	1/8	20	40	80	200
2												
1	1000	21.4			21.4	21.2	1.2	0.0	0.0	0.0	0.0	0.0
1A	1800	38.5			38.5	38.5	35.5	3.0	0.2	0.2	0.2	0.2
1B												
FINES	1775	38.0			38.0	38.0	38.0	35.9	19.8	10.6	3.8	0.6
Min. Filler	100	2.1			2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1
TOTAL	4675				100.0	99.8	76.8	41.0	22.1	12.9	6.1	2.9
JOB MIX LIMITS					100	95/100	68/78	37/49	19/33	10/22	3/9	2/6

Lbs. Bitumen Batched 325

% BITUMEN 6.5

JOB MIX LIMITS 6.0-6.8

MM 5.2 Apr. '67

5.2-7

NEW YORK STATE
DEPARTMENT OF PUBLIC WORKS
BUREAU OF MATERIALS

"PLANT INSPECTION OF BITUMINOUS CONCRETE"
HOT BIN UNIFORMITY TEST

I. SCOPE

This method describes specific procedures for sampling aggregates from individual hot bins, determining the primary size percentage between two sieves, and using this percentage to determine the uniformity of the bin. Determination of uniformity from the results of complete hot bin analysis is also described.

II. GENERAL

A. GENERAL DEFINITION

For the purpose of this method, non-uniformity of hot bins is defined as variability of the gradation of aggregate in any hot bin over a relatively short period of time. The quantitative control of this variability will be defined as follows: "A coarse aggregate bin shall be considered uniform when the primary size aggregate in that bin does not vary more than $\pm$ 12% from the primary size determined from the last complete hot bin analysis, and when the primary size aggregate in that bin comprises at least 70% of the bin material. A fine aggregate bin shall be considered uniform when the aggregate in that bin passing the 1/8" sieve and retained on the #20 sieve does not vary by more than $\pm$ 12% from that determined from the last complete hot bin analysis." Note that the 70% requirement does not apply to the fine bin.

For the case where the No. 3 and No. 2 stone sizes are blended in the hot bin, the same coarse aggregate uniformity criteria shall apply with the exception that

FIGURE 1

FORM BR 163a (3/64) NEW YORK STATE DEPARTMENT OF PUBLIC WORKS BUREAU OF MATERIALS

SUMMARY OF HOT BIN UNIFORMITY TESTS

PLANT XYZ BLACKTOP MIX PRODUCED 1A TOP INSPECTOR Joseph Bushey

DATE	BIN PERCENTAGES														
	2			1			1A			1B			FINES		
	COMPLETE ANALYSIS		UNIFORMITY TEST	COMPLETE ANALYSIS		UNIFORMITY TEST	COMPLETE ANALYSIS		UNIFORMITY TEST	COMPLETE ANALYSIS		UNIFORMITY TEST	COMPLETE ANALYSIS		UNIFORMITY TEST
	PRIMARY SIZE ( )	ACCEPTABLE RANGE		PRIMARY SIZE (½-¼)	ACCEPTABLE RANGE		PRIMARY SIZE (¼-⅛)	ACCEPTABLE RANGE		PRIMARY SIZE ( )	ACCEPTABLE RANGE		PRIMARY SIZE (⅛-20)	ACCEPTABLE RANGE	
6/16/67				84.0			77.1						35.9		
"				87.2	75-99		75.4	70-87					38.1	26-50	
"					" "	90.3		" "	77.8					" "	39.9
"					" "	85.1		" "	80.1					" "	42.0
"					" "	86.3		" "	76.6					" "	39.7
"					" "	87.1		" "	74.9					" "	38.0
6/17/67				89.7	78-100		77.3	70-89					40.2	28-52	
"					" "	90.1		" "	79.6						37.4

the primary size shall be considered that material which passes the two-inch (2") sieve and is retained on the one-half inch (½") sieve.

B. UNIFORMITY AS PART OF A COMPLETE BIN ANALYSIS

When running a complete hot bin analysis, the material of the coarse aggregate bins must be at least 70% primary size to be considered uniform. Since a combined gradation is always determined as part of the complete hot bin analysis, the ± 12% requirement does not apply.

III. SAMPLING

Methods of bin sampling shall be as described in Materials Method 5.2 "HOT BIN ANALYSIS" except that where feasible, the sample may be taken directly from the bin and sieved without splitting. The size of sample may be varied at the direction of the District Office from that required for hot bin analysis while making uniformity determinations so long as a minimum of 2 pounds from any coarse aggregate bin is sieved. However, in no way does this imply that variations may be made from the specified sampling procedure or sample size when a complete hot bin analysis is made.

IV. CALCULATIONS

The calculations required are illustrated by reference to Figure 1. A plant is producing the mix indicated from three aggregate bins. It is assumed that the plant has just begun or resumed production. The percentages of primary size as determined by the initial complete hot bin analysis were recorded. The Inspector, instead of switching immediately to uniformity testing, decided in this case to run another complete bin analysis even though the first indicated a gradation within the job mix formula limits and all coarse aggregate bins uniform. The primary size determination as determined by this second analysis is now used to establish the acceptable range for the next few uniformity tests. In the case

of the No. 1 bin shown in Figure 1, the primary size of 87.2 ± 12% or 75% - 99%* establishes the range for the next four uniformity test results, whereupon another complete bin analysis is run and sets a new range of 89.7 ± 12% or 78% - 100%* for subsequent uniformity results.

The same general procedure is followed for the other bins. However, the primary size of 75.4% in the 1A bin sets a range of 70 to 87%* since a 70% minimum for all but the fine bin is required in addition to the ± 12% criteria.

* Note that although they are initially calculated to the nearest 0.1%, primary sizes are always rounded to the nearest whole percent when establishing uniformity ranges or when used to judge uniformity.

NEW YORK STATE
DEPARTMENT OF PUBLIC WORKS
BUREAU OF MATERIALS

"PLANT INSPECTION OF BITUMINOUS CONCRETE"
BITUMEN EXTRACTION TESTS

I. SCOPE

This method describes specific sampling and testing procedures necessary for routine field determination of bitumen content and aggregate gradation based on samples of the final mix. Determination of total percent passing all sieves larger than the #80 is approximate and such results are to be used only in conjunction with hot bin analyses as a guide to plant adjustments.

II. APPARATUS

The minimum equipment necessary for the performance of the extraction is as follows:

1. Extraction apparatus of at least 1000 grams capacity. If a centrifuge, it must be capable of being revolved at controlled speeds up to 3600 rpm and shall have explosion-proof features, a shell for catching the solvent, and a drain for removing the solvent. Installation shall be under a hood or in a very well ventilated area.
2. Hot plate and pan for drying aggregate.
3. Balance of at least 1000 gram capacity, accurate to 0.1 grams.
4. Filter rings to fit the bowl of the centrifuge extractor, or filter paper for the reflux extractor.
5. Metal spatula - 6" blade.
6. #8 stencil brush, medium stiff bristles.
7. Solvent for bitumen; Sovasol #5 or trichloroethylene are recommended; however, other solvents proven by past experience may be used.

III. SAMPLING

The minimum size of samples on which the test is run shall be 1000 grams for all top courses.

Plant samples shall be taken from one batch in the truck. The top foot of material shall first be removed. A scoop shall be forced vertically downward and a large trowel pushed in beside it to keep the material in the scoop as it is lifted out.

IV. DETERMINATION OF BITUMEN CONTENT (CENTRIFUGE EXTRACTOR)

Carefully weigh a quantity of material slightly less than the capacity of the extractor. "Dribbling" material to exactly meet a predetermined weight such as 1000 grams is poor testing practice and shall be avoided.

Next, add sufficient solvent to the mixture until all aggregates are covered while gently separating the particles with the spatula until the solvent has worked into all voids.

Place the bowl, containing the mixture and solvent, in the centrifugal machine and place a filter ring (after first determining its weight) on the edge of the bowl; then place the cover on the filter ring and draw down snugly by means of the combination milled nut and funnel arrangement.

Start the bowl rotating slowly at first in order to permit the aggregate to be distributed uniformly around the inside of the bowl. Gradually increase the speed, by means of the regulator, until the dissolved bitumen flows from the spout in a thin stream, continuing until the first charge has drained. Shut off the motor and allow the bowl to stop, adding a fresh portion of solvent thru the funnel-milled nut arrangement (200 cc to 250 cc depending upon the size of the original sample). This operation is repeated until the sample has been washed a minimum of three times. The extracted liquid, when observed in a separate container, should be clear or at least not darker than a light straw color. With a little experience, the operator can soon gauge exactly what treatment is necessary for any given material.

When the last addition of solvent has drained off, remove the bowl, with cover plate intact, and place on a sheet of manila paper. Carefully remove the cover plate and filter ring and brush all fine material adhering to each into a pan. Then dry and weigh the filter paper. The increase in weight is considered as material passing #200 sieve. Carefully loosen the damp sample in the bowl with a small metal spatula and then brush into the pan, making sure that all material is removed from the bowl, spatula and brush. If any of the material falls on the sheet of manila paper, this should also be brushed into the pan, and the pan heated on a hot plate until dry.

When the sample is dry, it is allowed to cool to room temperature, then carefully brushed into a balance pan and weighed. The difference between this weight (adding the increase in dried filter weight) and the original weight of the sample placed in the bowl will be the weight of bitumen extracted.

V. DETERMINATION OF BITUMEN CONTENT (REFLUX EXTRACTOR)

Line the extractor cones with dried and weighed filter paper folded to form a 3-ply cone with a single 1-ply seam and carefully weigh a quantity of material slightly less than the extractor capacity. "Dribbling" material to exactly meet a predetermined weight such as 1000 grams is poor testing practice and shall be avoided.

Assemble the cones in the frame and place in the extractor jar. Carefully pour about 500 ml. of the solvent over the sample in the top cone. At no time shall the level of solvent in the extractor jar contact the tip of the lower cone.

Place the apparatus on an electric hot plate, circulate cold water through the condenser and adjust the electric heater so that a steady flow of solvent drips into the top cone. At no time should the level of solvent overflow the filter cones but should be sufficient to cover the samples.

When the solvent running from the lower filter is colorless as viewed against a white background, shut off the heat but allow the condenser to operate until the frames can be handled.

Finally, remove the filter cones and dry to a constant weight. The difference between this weight and the original sample and cone weight will be the weight of bitumen extracted. Subtract the original weight of filter paper to determine aggregate weight.

VI. GRADATION DETERMINATION

Additional equipment required for this test includes a mechanical sieve shaker and a nest of sieves of the required sizes to determine the Specification gradation.

The aggregate sample used shall consist of the entire quantity of aggregate from which the bituminous material has been extracted. This weight was the final dry weight of the aggregate extracted and was previously recorded.

Place the aggregate sample in the nest of sieves containing the various sizes required by the Specification item, covering the mixture with a pan under the #200 sieve and a cover above the top sieve. Then place the sieves in the mechanical shaker and sieve for approximately 10-15 minutes. At the end of this period, remove the sieves from the shaker and record the weight of material retained on each sieve, including the amount passing the #200 and retained on the pan. The sum of these various weights should check the dried weight of the aggregate after extraction.

Care must be taken so as not to overload the 8" diameter fine aggregate sieves. As a guide, when the #80 and/or the #200 sieves are loaded in excess of 200 grams and/or any of the remaining sieves retain more than approximately 300 grams of material at the end of the test, the sieves shall be considered overloaded. When overloading occurs, it will be necessary to sieve only portions of the sample at a time, adding the results to obtain the total gradation. Scalping sieves may be introduced into the nest of sieves above the critical sizes as another method to prevent an overloaded condition.

In weighing the material retained on the sieves, the loose material is dumped on the balance pan, then the sieve is placed upside down on manila paper and the bottom of the sieve brushed with a medium stiff bristle brush such as #8 stencil brush. After brushing, the sides of the sieves should be tapped sharply with the wooden handle of the brush; this will dislodge all the loosened particles so that they will fall to the paper. These particles are brushed into the balance pan and weighed with the remainder of the material retained.

VII. CALCULATIONS

The bitumen content of the sample is equal to:

$$\% \text{ Bitumen} = \frac{Ws - Wa}{Ws} \times 100$$

Where: Ws = Weight of the sample before extraction
Wa = Weight of the dried aggregate after extraction (including the increase of the filter dry weight)

The aggregate gradation calculations will be illustrated by an example.

A sample of a 1A top mix weighs 1051.0 grams. After extraction, the dried aggregate weighs 986.0 grams. The aggregate weights retained on each sieve are recorded in the "Grams Retained" column shown on Figure 1.

Next, these weights are expressed as percentages of the total aggregate weight and recorded in the "% Retained" column.

Example: % Retained on #200 = $\frac{41}{986}$ X 100 = 4.1%

% Retained by Pan = $\frac{45*}{986}$ X 100 = 4.6%

*Includes 5 grams increase in filter weight.

The results in the "Cumulative % Passing" column are obtained by adding the figures recorded in the "% Retained" column from the smallest sieve upwards to the largest.

Example: % Passing #200 = 4.6
% Passing #80 = 4.6 + 4.1 = 8.7
% Passing #40 = 8.7 + 5.9 = 14.6

Note that the top cumulative percent passing should always come within a few tenths of 100.0% as a check of the computations. The slight discrepancy of a few tenths can be attributed to the rounding of the figures or slide rule accuracy.

However, it should be noted that the aggregate job mix tolerances are expressed to the nearest whole percent. Therefore, in determining whether or not a gradation is acceptable, the results are to be rounded to the nearest whole percent. Accordingly, if the % passing the #200 sieve was 1.5, 1.6, etc., it would be rounded to 2%. If the percentage was 6.4, 6.3, etc., it would be rounded to 6%.

The bitumen content results are always expressed to the nearest 0.1%

MM 5.4 Apr. '67
Form BR-160 (4/63)

FIGURE 1

STATE OF NEW YORK
DEPARTMENT OF PUBLIC WORKS
BUREAU OF MATERIALS

BITUMINOUS CONCRETE PLANT EXTRACTION RESULTS

District 11 Sample No. _____

Plant XYZ BLACKTOP CO. Location PARKVILLE, N.Y.

This test represents 1 days production of Item No. 51M

Mix type 1A TOP COURSE Job Mix Formula No. 2

Type of Sample; Plant X, Paving _____.

Date Sampled 6/9/67 By Joseph Bushey

Weight of Sample 1051.0 grams

Weight of Aggregate 986.0 grams % Bitumen Content 6.2

Weight of Bitumen 65.0 grams Job Mix Limits 5.8-6.4

SIEVE ANALYSIS

Sieve	Grams Retained	% Retained	Cumulative % Passing	Job Mix Limits
2"				
1 1/2"				
1"	0	0.0	100.0	100
1/2"	25	2.5	97.5	95-100
1/4"	197	20.0	77.5	75-85
1/8"	278	28.2	49.3	43-55
#20	270	27.4	21.9	15-29
#40	72	7.3	14.6	7-19
#80	58	5.9	8.7	5-11
#200	41	4.1	4.6	2-6
Pan	45	4.6		
Totals	986			

Computed By Joseph Bushey

NEW YORK STATE
DEPARTMENT OF PUBLIC WORKS
BUREAU OF MATERIALS

"PLANT INSPECTION OF BITUMINOUS CONCRETE" AGGREGATE AND BITUMEN SCALE TESTS

I. SCOPE

This method describes specific procedures for the testing of the accuracy and sensitivity of aggregate and bitumen scales. A guide for visual inspection of the scale components is also included. Similar procedures to be followed at those plants where the bitumen is added by meter are described in Materials Method N.Y. 5.6, "BITUMEN METER TESTS."

II. GENERAL

The Inspector shall check the aggregate and bitumen scales before the start of annual production and at least once every 60 days. These checks supplement those performed by the Producer's scale technician.

Aggregate and bitumen scales are tested by the build-up loading method, using the fifty-pound weights supplied by the Producer. Results of these tests are recorded on Form BR-185 and are kept as part of the plant records.

The total batch size referred to in the following sections is defined as "the total weight of any batch produced." The total batch size used for checking scale accuracy, sensitivity and minimum gradations (See Figures 1 and 2) is the minimum allowable batch weight approved for the plant. This minimum batch size is usually one-half of the rated capacity of the pugmill.

Should these tests indicate that the scales do not meet the Department's requirements, the Producer shall be notified that production will not be acceptable until the scales are properly adjusted.

III. VISUAL INSPECTION

The aggregate and bitumen scales shall be inspected visually as follows:

FIGURE 1

BR-185a (4/66)

NEW YORK STATE DEPARTMENT OF PUBLIC WORKS
BUREAU OF MATERIALS

BITUMINOUS PLANT SCALE CHECK

DISTRICT 11 DATE 6/18/67

PLANT XYZ BLACKTOP CO.

LOCATION PARKVILLE, N.Y.

SCALE TYPE Aggregate _____ Asphalt X

MAKE ACE SCALES MODEL NO. K-411

CAPACITY 500# MIN. GRADUATIONS 0.5#

TOTAL BATCH SIZE 4000#

CHECKED BY Joseph Bushey

~~AGGREGATE SCALE~~

~~Min. Graduations _____ × 0.005 = _____~~

~~Sensitivity _____ × 0.0025 = _____~~

~~Accuracy _____ × 0.005 = _____~~

BITUMEN SCALE

Min. Graduations	2000	× 0.0005 =	1.0#
Sensitivity	2000	× 0.00025 =	0.5#
Accuracy	2000	× 0.001 =	2.0#

VISUAL INSPECTION RESULTS:

SATISFACTORY

LOAD TEST

Increment	COL. 1 Dial Reading Material Added	COL. 2 Actual Weight Material Added	COL. 3 Actual Weight Material + Weights	COL. 4 Dial Reading Material + Weights	COL. 5 Scale Error High	COL. 5 Scale Error Low	COL. 6 Sensitivity Yes	COL. 6 Sensitivity No
1	0	0	50	50	0		☑	☐
2			100	101	1		☑	☐
3			150	151.5	1.5		☑	☐
4			200	202	2		☑	☐
5			250	251.5	1.5		☑	☐
6			300	300	0		☑	☐
7			350	349.5		0.5	☑	☐
8			400	398		2	☑	☐
9			450	449		1	☑	☐
10							☐	☐
11							☐	☐
12							☐	☐
13							☐	☐
14							☐	☐
15							☐	☐
16							☐	☐
17							☐	☐
18							☐	☐
19							☐	☐
20							☐	☐
21							☐	☐
22							☐	☐
23							☐	☐
24							☐	☐
25							☐	☐

1. The lever system, knife edges and bearings shall be checked for cleanliness and that no moving part is binding against any other part.

2. Knife edges and bearings shall be sharp and be free from excessive wear.

3. Sliding weights on the scale levers shall be tightened into position.

4. The dial face and glass shall be clean and undamaged.

5. The dial face shall be equipped with a full complement of adjustable index pointers.

6. The dial pointer shall stand at zero with no load and shall swing freely when it or the pan lever are touched with the finger.

7. The minimum scale graduation shall be noted and recorded on Form BR-185.

8. Any defects noted during the visual inspection shall be entered under "Visual Inspection Results" on Form BR-185.

IV. ACCURACY TEST - BITUMEN SCALE

The accuracy of the bitumen scale shall be checked as follows: (See Figure 1 for an example of this procedure)

1. Record the zero dial reading in Column 1 of Form BR-185. If necessary, add a cradle from which to suspend weights and either tare the scale to zero or record the tare weight and treat this as the "new zero." Generally, weights can be placed directly on the bitumen weigh bucket.

2. Add one fifty-pound weight and record the true weight added in Column 3.

3. Compute the scale error by determining the difference in the true weight added and the final dial reading. Also note whether this error is "high" or "low." This scale error, whether "high" or "low," is compared to the allowable scale error which is computed by multiplying the total batch weight by 0.1 percent. Enter the scale error in Column 5.

FIGURE 2

BIR-185a (4/66)

NEW YORK STATE DEPARTMENT OF PUBLIC WORKS
BUREAU OF MATERIALS

BITUMINOUS PLANT SCALE CHECK

DISTRICT 11 DATE 6/8/67

PLANT XYZ BLACKTOP CO.

LOCATION PARKVILLE, N.Y.

SCALE TYPE Aggregate X Asphalt

MAKE ACE SCALES MODEL NO. K-307

CAPACITY 5000# MIN. GRADUATIONS 5#

TOTAL BATCH SIZE 4000#

CHECKED BY Joseph Bushey

AGGREGATE SCALE

Min. Graduations	2000	x 0.005 =	10#
Sensitivity	2000	x 0.0025 =	5#
Accuracy	2000	x 0.005 =	10#

BITUMEN SCALE

Min. Graduations		x 0.0005 =	
Sensitivity		x 0.00025 =	
Accuracy		x 0.001 =	

VISUAL INSPECTION RESULTS:

SATISFACTORY

LOAD TEST

Increment	COL. 1 Dial Reading Material Added	COL. 2 Actual Weight Material Added	COL. 3 Actual Weight Material + Weights	COL. 4 Dial Reading Material + Weights	COL. 5 Scale Error High	COL. 5 Scale Error Low	COL. 6 Sensitivity Yes	COL. 6 Sensitivity No
1	0	0	500	495		5	☑	☐
2	500	505	1005	1000		5	☑	☐
3	1000	1005	1505	1495		10	☑	☐
4	1500	1510	2010	2005		5	☑	☐
5	2000	2005	2505	2505		0	☑	☐
6	2500	2500	3000	3000		0	☑	☐
7	3000	3000	3500	3505	5		☑	☐
8	3500	3495	3995	4000	5		☑	☐
9							☐	☐
10							☐	☐
11							☐	☐
12							☐	☐
13							☐	☐
14							☐	☐
15							☐	☐
16							☐	☐
17							☐	☐
18							☐	☐
19							☐	☐
20							☐	☐
21							☐	☐
22							☐	☐
23							☐	☐
24							☐	☐
25							☐	☐

4. Add the weights one at a time, insuring that the weights are uniformly distributed around the bucket, record the dial reading and determine scale error. This procedure is continued until the upper limit of bitumen batching is reached. Note that this upper limit may not necessarily be the full capacity of the scale.

V. SENSITIVITY TEST - BITUMEN SCALE

A test for sensitivity of the bitumen scale shall be made at each 50-pound increment of loading during the accuracy test. A weight equal to 0.025 percent of the total batch weight shall be placed on the weigh bucket and there must be an immediate reaction of the scale pointer. The pointer movement or lack of movement shall be noted in Column 6 of Form BR-185.

VI. ACCURACY TEST - AGGREGATE SCALE

The accuracy of the aggregate scale shall be checked as follows: (See Figure #2 for an example of this procedure)

1. Record the zero dial reading. If it is necessary to place a cradle, platform or other device on the aggregate weigh box on which to suspend or place weights, either tare the scale to zero or record the cradle weight and treat this reading as the "new zero." Enter this reading in Column 1 of Form BR-185.

2. Suspend the ten fifty-pound weights from the weigh box and enter 500 pounds in Column 3. (The procedure as described assumes that the dial reading after a cradle has been placed on the weigh box is actually zero. This procedure can be modified to include the tare weight of the cradle if necessary).

3. After the weights have been added, record the dial reading in Column 4.

4. Determine the scale error by noting the difference in the true weight added and the final dial reading. This error is expressed in pounds and the error is "high" if the final dial reading is greater than true weight added and the error is "low" if the final dial reading is less than true weight added. This error, whether "high" or "low," is compared to the allowable scale error which is computed by multiplying the total batch weight by 0.5 percent. Enter the scale error in Column 5.

5. Remove the weights from the weigh box.

6. Add aggregate to the weigh box until the dial reading is 500+ pounds. It is desirable to add an amount of aggregate which will cause the dial reading to be a multiple of 500 pounds but it is not absolutely necessary since true weights can be determined regardless of the dial reading. Record the dial reading in Column 1.

7. Determine the true weight of material added by applying the previous increment scale error to the dial reading. For example, if the dial reading with material added is 500 pounds and the previous increment scale error was 5 pounds "low," the actual weight of material added is 505 pounds. Enter the actual weight in Column 2.

8. Suspend the ten fifty-pound weights from the weigh box and enter in Column 3 the sum of the true weight of material added and 500 pounds.

9. Record the final dial reading in Column 4 and compute the scale error and enter this in Column 5.

10. Continue this procedure by adding 500 pounds of material, recording the dial reading, computing the true weight of material, adding 500 pounds of weights, computing the true weight of material plus weights, recording the final dial reading and determining the scale error. This procedure is stopped when the upper limit of normal aggregate batching is reached. Note that this may not necessarily be the full range of the dial.

VII. SENSITIVITY TEST - AGGREGATE SCALE

A test for sensitivity of the aggregate scale shall be made at each 500-pound increment of loading during the accuracy test. A weight equal to 0.25 percent of the total batch weight shall be placed on the weigh box weight cradle and there must be an immediate reaction of the scale pointer. The pointer movement or lack of movement shall be noted in Column 6 of Form BR-185.

NEW YORK STATE
DEPARTMENT OF PUBLIC WORKS
BUREAU OF MATERIALS

"PLANT INSPECTION OF BITUMINOUS CONCRETE"
BITUMEN METER TESTS

I. SCOPE

This method describes specific procedures for testing the calibration and accuracy of bitumen metering devices.

II. GENERAL

There are currently several types of bitumen meters in use in bituminous mixing plants, including meters with and without temperature compensation devices. This method describes a general test procedure which will provide the Plant Inspector with data necessary to check meter calibration and accuracy. Once the Inspector has completed the test outlined in "III TEST PROCEDURE", the appropriate section in "IV ANALYSIS OF RESULTS" should be consulted, calculations made and a determination made of whether or not actual results are compatible with desired results. Test results will be filed with the plant records.

The procedure outlined in this Method should not be confused with a test of "delivery tolerance settings" which is described in Materials Method N.Y. 5.1 "INSPECTION OF AUTOMATED BATCH PLANTS".

Should these tests indicate that the meter does not meet the Department's requirements, the Producer shall be notified that production will not be acceptable until the meter is properly adjusted.

III. TEST PROCEDURE

A. GENERAL

Bitumen meters in approved plants are equipped with bypass valves and lines which enable the Inspector to obtain samples for testing the meter. The location of the lines and the point at which the sample is taken will vary from plant to plant. In some plants, it is possible to obtain the sample at the meter which is usually on the mixing platform. In other plants, it is necessary to extend a pipe from the meter down to ground level. These factors are important since significant amounts of bitumen can adhere to the inside surfaces of these lines.

In order to conduct the test, it is necessary to have one or two barrels or other suitable containers and a large capacity scale (preferably a platform scale with minimum graduations of 0.25 pounds).

B. SAMPLE SIZE

The sample size should be at least equal to the quantity batched into a typical batch.

C. PROCEDURE

1. Determine sample size.
2. Obtain weight of the empty container.
3. Heat valves and lines by wasting bitumen (can be small amounts, manually drawn).
4. After the last waste is drawn, allow the bitumen to drain into the waste container for one minute.
5. Draw sample (automatically or manually) into sample container. Observe final meter reading.
6. After the sample is drawn, allow the bitumen to drain into the sample container for one minute.
7. Obtain weight of the filled container and determine the weight of bitumen sample.
8. See appropriate section in "IV ANALYSIS OF RESULTS" and make necessary calculations. Compare results.

IV. ANALYSIS OF RESULTS

A. GENERAL

The following sections explain, by the use of example problems, the calculations required in order to compare results. In each case, a final comparison is made between the actual weight of the bitumen sample and the theoretical weight of the bitumen desired or as indicated by the meter plus or minus the allowable tolerance.

Table 1 contains factors used in the analysis of results when the bitumen is an asphalt cement.

B. ALLOWABLE ACCURACY TOLERANCES

The accuracy tolerance for bitumen measuring devices is $\pm$ 0.1 percent of the normal total batch weight. e.g. Assume a 5000 lb. batch plant. Accuracy tolerance = 5000 X 0.1% = $\pm$ 5.0 lb.

C. METER WITHOUT TEMPERATURE COMPENSATION

Meters of this type deliver gallons. The meter reading is the actual gallonage delivered at line temperature.

Test Data:

Temperature	= 300°F
Specific Gravity @ 60°F	= 1.02
Meter Reading (observed)	= 20 gal.
Asphalt Test Weight	= 155.0 lb.

Find:

Asphalt Theoretical Weight

Solution:

Theor. Weight = 20 X 7.804 (Table 1) = 156.1 lb.

Compare test weight with theoretical weight

D. METER WITH INTERNAL TEMPERATURE COMPENSATION (FORMULA SETTING IN GALLONS)

Meters of this type deliver "60°F gallons". A temperature compensating device in the meter corrects the flow of bitumen when temperature changes occur. The formula draw setting and the meter pointer represent 60°F gallonage.

Test Data:

Specific Gravity @ 60°F	= 1.02
Meter Reading (observed)	= 20-60°F gal.
Asphalt Test Weight	= 169.0 lb.

Find:

Asphalt Theoretical Weight

Solution:

Theor. Weight = 20 X 8.495 (Table 1) = 169.9 lb.

Compare test weight with theoretical weight

E. METER WITH INTERNAL TEMPERATURE COMPENSATION (FORMULA SETTING IN POUNDS)

Meters of this type deliver "pounds" based on "60°F gallons". A temperature compensating device in the meter corrects the flow of asphalt when temperature changes occur. The formula draw setting and the visual indicating device on the panel or recorder represent pounds of bitumen based on 60°F gallonage.

Test Data:

Panel Reading (observed)	= 200 lb.
Asphalt Test Weight	= 199 lb.

Find:

Asphalt Theoretical Weight

Solution:

Theor. Weight = 200 lb. (Same as observed weight)

Compare test weight with theoretical weight.

TABLE 1

POUNDS PER GALLON FOR ASPHALT

Legend:
T = observed temperature in degrees Fahrenheit
G = specific gravity at 60°F

T \ G	0.975	0.980	0.985	0.990	0.995	1.000	1.005	1.010	1.015	1.020	1.025	1.030	1.035	1.040	1.045	1.050
60	8.120	8.162	8.203	8.245	8.287	8.328	8.370	8.412	8.453	8.495	8.536	8.578	8.620	8.661	8.703	8.745
225	7.662	7.702	7.740	7.780	7.820	7.858	7.898	7.938	7.976	8.016	8.055	8.094	8.134	8.173	8.212	8.252
230	7.648	7.688	7.726	7.766	7.806	7.844	7.884	7.923	7.962	8.001	8.040	8.080	8.119	8.158	8.197	8.237
235	7.634	7.674	7.712	7.752	7.791	7.830	7.869	7.909	7.948	7.987	8.026	8.065	8.105	8.143	8.183	8.222
240	7.621	7.660	7.699	7.738	7.777	7.816	7.855	7.895	7.933	7.973	8.011	8.050	8.090	8.128	8.168	8.207
245	7.608	7.647	7.685	7.725	7.764	7.803	7.842	7.881	7.920	7.959	7.997	8.037	8.076	8.114	8.154	8.193
250	7.594	7.633	7.671	7.711	7.750	7.788	7.828	7.867	7.905	7.945	7.983	8.022	8.061	8.100	8.139	8.178
255	7.581	7.620	7.658	7.698	7.737	7.775	7.814	7.853	7.892	7.931	7.969	8.008	8.048	8.086	8.125	8.164
260	7.567	7.606	7.644	7.684	7.723	7.761	7.800	7.839	7.877	7.916	7.955	7.994	8.033	8.071	8.110	8.149
265	7.553	7.592	7.630	7.669	7.709	7.747	7.786	7.825	7.863	7.902	7.940	7.979	8.018	8.056	8.096	8.135
270	7.540	7.579	7.617	7.656	7.695	7.733	7.772	7.811	7.849	7.888	7.927	7.966	8.005	8.043	8.082	8.121
275	7.526	7.565	7.603	7.642	7.681	7.719	7.758	7.797	7.835	7.874	7.912	7.951	7.990	8.028	8.067	8.106
280	7.513	7.552	7.590	7.629	7.668	7.706	7.745	7.784	7.822	7.860	7.898	7.937	7.976	8.014	8.053	8.092
285	7.500	7.538	7.576	7.615	7.654	7.692	7.731	7.769	7.807	7.846	7.884	7.923	7.961	7.999	8.038	8.077
290	7.487	7.525	7.563	7.602	7.641	7.678	7.717	7.756	7.794	7.832	7.870	7.909	7.948	7.985	8.024	8.063
295	7.474	7.512	7.550	7.589	7.627	7.665	7.704	7.742	7.780	7.819	7.857	7.895	7.934	7.972	8.010	8.049
300	7.460	7.498	7.536	7.575	7.613	7.651	7.690	7.728	7.766	7.804	7.842	7.881	7.919	7.957	7.995	8.034
305	7.447	7.485	7.523	7.561	7.600	7.638	7.676	7.715	7.752	7.791	7.828	7.867	7.905	7.943	7.982	8.020
310	7.433	7.471	7.509	7.547	7.586	7.623	7.662	7.700	7.738	7.776	7.814	7.852	7.891	7.928	7.967	8.005
315	7.420	7.458	7.496	7.534	7.573	7.610	7.649	7.687	7.724	7.763	7.800	7.839	7.877	7.914	7.953	7.991
320	7.407	7.445	7.483	7.521	7.559	7.597	7.635	7.673	7.711	7.749	7.787	7.825	7.863	7.901	7.939	7.977
325	7.393	7.432	7.469	7.507	7.545	7.583	7.621	7.659	7.696	7.735	7.772	7.810	7.849	7.886	7.924	7.962

NEW YORK STATE
DEPARTMENT OF PUBLIC WORKS
BUREAU OF MATERIALS

"PLANT INSPECTION OF BITUMINOUS CONCRETE"
AGGREGATE MOISTURE CONTENT TESTS

I. SCOPE

This method describes specific procedures for test determinations of the moisture content in hot bin aggregates. Test criteria and corrective steps, when necessary, are also included.

II. GENERAL

The moisture content shall be determined by drying the sample to constant weight and the weight loss calculated as the percentage of moisture. Testing frequency shall be at least once a week for each bin and each time a change is suspected in the moisture content of the cold feed aggregates.* When the aggregate source remains the same, and experience (documented by prior test results) indicates one particular bin to be the critical one for routine testing, then the other bins need not be tested so long as the critical bin remains satisfactory.

Should the moisture content as determined for any bin exceed 0.5% of the dry aggregate weight, that bin shall be drawn down and refilled.

III. SAMPLING

Methods of bin sampling shall be as described in Materials Method N.Y. 5.2 "HOT BIN ANALYSIS" except that the sample may be taken in quantities of 750 to 1000 grams directly from the bin without splitting.

IV. TESTING

Transfer the sample into a tared pan and weigh. Heat the pan and sample on a hot plate or stove and occasionally stir the sample. Continue drying until an apparently constant weight is obtained. The drying time for each aggregate type and size will vary, depending on the aggregate characteristics and moisture content.

All weight determinations should be carefully and accurately made to the nearest 0.1 gram.

* This particular frequency is to be considered as a suggested testing rate. Should individual plant conditions dictate a lower routine testing rate, the District Office may execute a written directive to the plant Inspector, setting a specific minimum testing rate which will then supersede the Materials Method figure.

V. CALCULATIONS

The percentage of moisture is calculated as follows:

$$\text{Moisture, percent} = \frac{B-C}{C-A} \times 100$$

where: A = weight of container
B = original weight of sample and container
C = weight of sample and container after drying

The final determined moisture content shall be recorded in the Inspector's diary.

NEW YORK STATE
DEPARTMENT OF PUBLIC WORKS
BUREAU OF MATERIALS

"PLANT INSPECTION OF BITUMINOUS CONCRETE" PLANT APPROVAL

I. SCOPE

This method describes specific procedures for obtaining the approval of bituminous mixing plants required before production is allowed for New York State projects. Plant requirements and inspection criteria are also described.

II. GENERAL

Prior to initial plant production during any calendar year, an inspection is made by the District Office to determine if the physical equipment and site conditions are such as to permit the uniform production of mixes within Specification. Criteria for such inspections are outlined in the General Specifications and Section IV of this Materials Method.

All plant inspection reports compiled by the District are submitted to the Bureau of Materials for review. Approval is granted by the Division of Operation and Maintenance upon favorable recommendation by the Bureau of Materials.

In addition to the above annual inspections, an inspection of the automation and recordation equipment by the Bureau of Materials is required. The detailed requirements for automation and recordation are described in Section V of this Materials Method.

III. APPROVAL PROCEDURE

A. AUTOMATION AND RECORDATION INSPECTION

Before any such system can be approved, it is necessary to have the Bureau of Materials inspect the automation and recordation equipment. Upon request of the District, personnel from the Bureau of Materials will perform these inspections.

The District will be notified by letter of the results of this inspection. If the equipment is not satisfactory, it must be corrected and reinspected prior to approval.

B. ANNUAL DISTRICT INSPECTION

Prior to annual production, each plant requesting approval shall be inspected by the District Office. The results of these inspections will be recorded on Form BPIR-1. Three (3) copies of Form BPIR-1 shall be forwarded to the Bureau of Materials. Upon favorable recommendation by the Bureau of Materials, the Division of Operation and Maintenance will grant approval and return one (1) copy of the report to the District. In some cases, approval may be granted conditional upon the correction of some minor items. It is the District's responsibility to insure that these corrections are made.

Should any inspection report indicate unsatisfactory plant conditions, such conditions are noted on the report and returned without approval to the District. When the unsatisfactory plant conditions have been corrected, they are so noted by the District on the report which is then returned directly to the Division of Operation and Maintenance. In addition, approval may be withdrawn during the year should any detrimental condition arise subsequent to the initial inspection.

Upon favorable recommendation from the District and the Bureau of Materials, the General Supervisor of Highway Maintenance may issue temporary approvals for a stated length of time when he is of the opinion that uniform plant production will not be adversely affected. Temporary approval is always granted with the understanding that every possible effort is being made to correct the situation and that it may be withdrawn at any time.

C. SUBSTITUTION OF BATCH WEIGHTS FOR TRUCK WEIGHTS

The Producer has the option of using truck scales to determine payment weights or requesting perimssion to substitute recorded batch weights in lieu of truck weights. Such permission may be granted by the District Engineer only when the automation and recordation equipment has been approved by the Deputy Chief Engineer (Research) as in conformance with Specifications.

IV. INSPECTION CRITERIA, SELECTED ITEMS

The following items represent equipment for which the requirements are most often misinterpreted. Detailed requirements for other physical plant features are outlined in the Specifications.

A. INSPECTION FACILITIES

The inspection facility shall be a separate room or building with adequate benches, chairs, ventilation, telephone and equipped with the following:

1. Bitumen extraction apparatus, power driven centrifuge or reflux, with a minimum capacity of 1000 grams.

2. Coarse aggregate sieve shaker, power driven, with a minimum clear screen area of three (3) square feet. The shaker shall be attached to a firm anchorage.

3. Fine aggregate sieve shaker, power driven, for eight inch (8") minimum diameter sieves.

4. Scale, 30 pound minimum capacity, 0.01 lb maximum graduations.

5. Scale, 1000 gram minimum capacity, 0.1 gm maximum graduations.

6. Fine aggregate sample splitter with maximum opening of one-half (½") inch.

7. Stove, oven or hot plate suitable for sample drying.

8. Accessory equipment including sieves, solvent, filter paper, sample containers, scoops, brushes and pans.

B. TELL-TALE DEVICES

These devices shall be located at the lower quarter point of each hot bin and shall actuate a light located within view of the operator when the aggregate falls below this level.

C. HOT BIN SAMPLING FACILITIES

The sampling facility shall be an approved type meeting the requirements of the General Specifications which enables the Inspector to obtain representative samples from the full width and depth of the discharge stream from each hot bin. Access to the sampling facilities shall be safely obtained with no more difficulty than that required to climb a ladder leading to a secure platform with railings.

D. BITUMEN SAMPLING VALVE

The bitumen sampling valve shall be an approved type meeting the requirements of the General Specifications in a location easily accessible to the Inspector. Under no circumstances shall a bitumen sample taken through the manhole on the top of the tank be considered acceptable as a representative sample.

E. TEST WEIGHT CRADLES OR PLATFORMS

Test weight platforms shall consist of brackets of shelves which are or can be readily fixed to the weigh hopper and have a capacity of ten (10) fifty-pound (50) weights.

Cradles shall consist of chains or cables suspended from the weigh hopper on which ten (10) fifty-pound (50) weights can be readily added. Such suspension shall not interfere with the placement of aggregates into the weigh hopper at the same time.

V. AUTOMATION AND RECORDATION REQUIREMENTS

A. WEIGHT BATCH PLANTS

1. Definition

Weight batch plants are those in which the aggregate components of the mix are proportioned by weighing. Additions of bitumen are made by either weight or volume.

2. Automatic Proportioning

a. Scales - Aggregate and Bitumen

The requirements as to type, minimum graduations, sensitivity and accuracy are stated in the General Specifications.

b. Controls

The batching controls shall be capable of automatically proportioning all the mix ingredients in their required quantities within the delivery tolerances prescribed by the Specifications. In addition, the controls shall automatically control the pugmill charging, mixing and discharge cycle. The entire batching cycle shall be continuous and not require any manual operations.

An interlock system shall be imposed over all phases of the batching cycle. The batching cycle shall be interrupted whenever a hot bin becomes empty, or whenever an ingredient deviates from its allowable delivery range (this necessitates a zero interlock). In addition, the charging, mixing and discharge phases shall be timed and interlocked as prescribed by the Specifications.

The scales, meters and automatic controls shall be designed so that proportioning calibration, delivery tolerance settings and batching interlocks can be inspected readily.

If the bitumen is added to the mix volumetrically by a meter, the above requirements as to automatic proportioning, delivery tolerances, interlocks and inspection shall apply.

3. Recordation

a. General

Details of the proportioning process shall be recorded by strip charts (graphic) or digital recorders. The output of these recorders shall be compatible with the scale or meter indication within the specified delivery tolerances. Unless otherwise specified, weights can be recorded individually or cumulatively. The required data shall be recorded automatically with no manipulation required by the operator.

b. Strip Chart, Graphic Recorders

Strip charts shall be designed so all quantities including zero can be read directly. The resolution

of the strip chart for aggregate weights shall be a maximum of twenty (20) divisions per inch with each division corresponding to a maximum of 2% of minimum batch capacity. The Specifications prescribe that the minimum quantity to be mixed shall not be less than 50% of the rated capacity of the plant. The resolution of strip charts used for recording bitumen quantities shall be a maximum of twenty (20) divisions per inch with each division representing a maximum of 0.1% of minimum batch capacity. Each batch shall be automatically stamped with a time-date stamp. When more than one chart is used, each shall bear time-date stamp for each batch.

Should recording resolution be less than that required for minimum batch size, but adequate for rated capacity, the allowable minimum batch size shall be increased accordingly.

c. Digital Recorders, Tape Output

This type digital batch recorder shall produce a tape printed with the following minimum data for each batch:

1. Zero quantity on each scale and/or meter.

2. Batch quantities (individual aggregate weights and/or total aggregate batch weight, bitumen quantity).

3. Time and date.

d. Digital Recorders, Batch Ticket Printer

This type of digital recorder shall produce a ticket (the State requires two copies) printed with the following minimum data for each truck load:

1. Individual batch quantities (individual aggregate weights, bitumen quantity).

2. Time and date.

e. Recordation of Bitumen Quantities Added Volumetrically

Quantities of bituminous material added to the mix by a meter may be recorded in graphical or digital

form in terms of 60°F gallons or weight based on 60°F gallons if a temperature compensation device is used. The recordation may also be actual gallons with an additional recording of bitumen temperature.

B. VOLUME BATCH PLANTS

1. Definition

Volume batch plants are those in which aggregates are proportioned into a single batch by volumetric (pre-set bin volumes) rather than by weighing methods.

2. Automatic Proportioning

a. Scales - Aggregate and Bitumen

Section 2a under Weight Batch Plants shall apply.

b. Controls

Section 2b under Weight Batch Plants shall apply except that the delivery tolerance check and batching interlocks shall apply to only the bitumen, mineral filler, and total aggregate batch quantity. (This necessitates zero interlocks).

3. Recordation

a. General

Section 3a under Weight Batch Plants shall apply.

b. Recording Requirements and Equipment

The recordation requirements in volumetric batch plants shall provide the following minimum information for each batch:

1. Total aggregate batch weight.
2. Total bitumen quantity per batch.
3. Zero quantity on each scale and/or meter.
4. Time and date (for tickets, each load).

The recording equipment shall be of the type as detailed under Weight Batch Plants, Sections 3b, 3c, 3d and 3e.

C. CONTINUOUS MIX PLANTS

1. Definition

Continuous mixing plants are those in which both bitumen and aggregates are continuously and volumetrically proportioned into the mixer without definite batch intervals.

2. Interlocks

There shall be an interruption in the mixing process when the level in any aggregate hot bin falls below the level required for uniform feed or when the bitumen flow to the pugmill is cut off.

3. Automatic Test Unit, Operation and Recordation

The plant shall be equipped with a device which will receive diverted samples of bitumen and all aggregate sizes.

This device shall be capable of weighing the quantities either individually or cumulatively and recording these quantities. The number of revolutions of the feeder drive shaft during the sampling period or the time interval of this period shall also be recorded.

A strip chart or a digital recorder shall be used to record the above data. If a strip chart is used, the resolution (as described under Weight Batch Plants) shall be based on total sample weight.

A detailed description of the sampling and recording procedures and equipment may be found in the General Specifications, Part II, Section 8.

4. Truck Weight Recorder

This type of recorder shall be used in conjunction with platform scales weighing delivery vehicles when continuous recordation is not available. The following minimum data is required to be printed on a ticket (the State requires two copies) for each truck:

1. Weight - vehicle tare weight.

2. Weight - vehicle loaded.

3. Time and date.

The weights and the time and date shall be applied automatically on the ticket. The tare weight of the vehicle, however, may be applied to the ticket by one of the following methods:

1. Weigh each truck a minimum of two times per day and preset the tare weight in the recorder so that the tare weight will print simultaneously with the weight of the loaded truck.

2. Weigh each truck before each loading for the printed tare weight and weigh each truck again before the load is dispatched for the printed gross weight.

The recorder shall be interlocked such that the printer cannot be actuated until the scale weight indicator comes to a complete stop.

NEW YORK STATE
DEPARTMENT OF PUBLIC WORKS
BUREAU OF MATERIALS

"PLANT INSPECTION OF BITUMINOUS CONCRETE"
JOB MIX FORMULA APPROVAL

I. SCOPE

This method describes specific procedures for the submission and approval of job mix formula bitumen contents and aggregate gradations for bituminous concrete to be used on Department projects.

II. GENERAL

Job mix formulas from each plant for each mix type which satisfy the General Limits of the Specifications are prepared by the Producers of bituminous concrete each year prior to the start of production. The Producers submit the formulas on Department forms to the District Office having jurisdiction over those projects to be served by the plant. Upon a favorable District recommendation, indicated by the District Engineer's signature, the formulas are sent to the Bureau of Materials for approval. Once approved, three (3) copies of each formula (or more if requested by the District) are returned to the District for distribution: District Office, Plant Inspector, Producer.

All approved formulas have job mix tolerances that establish the specification limits which the Producer must meet when producing bituminous concrete. In no case shall a job mix formula have tolerances that fall outside of the General Limits. The aggregate tolerances are based upon total weight of the aggregate and allow for variations in production. The bitumen content, however, is based upon total weight of the batch and has an approved range so that the batching percentage may be varied within the limits by the District to obtain a mix with desired properties.

Production of any mix for New York State projects without an approved formula for that mix on file at the Inspector's office shall not be acceptable.

III. FORMULA CHANGES

Formula approval may be withdrawn at any time by the Deputy Chief Engineer (Research).

Occasionally changes in aggregate sources, aggregate characteristics and/or plant equipment during production periods may require the Producer to change the job mix formula. Such changes may be temporarily approved by the District Engineer until the new formula has been approved or rejected by the Deputy Chief Engineer (Research). Temporary approval should be granted only in those cases where a change is absolutely necessary to continue acceptable production and shall be immediately withdrawn if the new mix exhibits any signs of unsatisfactory behavior.

Should the District desire additional engineering information regarding any particular mix, specific instructions as to sample size and submission will be issued by the Bureau of Materials upon request.

NEW YORK STATE
DEPARTMENT OF PUBLIC WORKS
BUREAU OF MATERIALS

"PLANT INSPECTION OF BITUMINOUS CONCRETE" MIXING TIMES

I. SCOPE

This method describes specific procedures for obtaining approval for other than standard mixing times for any particular type mix as produced by a bituminous batch type mixing plant for New York State projects.

It does not apply to systems of "impact mixing" where the bitumen is applied as a high pressure spray to the falling aggregates. Approval and mixing time criteria for such systems must be obtained through the Bureau of Materials.

II. DEFINITIONS

A. CYCLE TIME: The interval of time between successive openings of the pugmill discharge gate for succeeding batches.

B. MIXING TIME: The interval of time between the opening of the aggregate weigh box gate and the opening of the pugmill discharge gate.

C. DRY MIXING TIME: The interval of time between the opening of the aggregate weigh box gate and the beginning of application of bituminous material.

D. WET MIXING TIME: The interval of time between the beginning of application of bituminous material and the opening of the pugmill discharge gate.

E. FINISH MIXING TIME: The interval of time between the termination of application of bituminous material and the opening of the pugmill discharge gate.

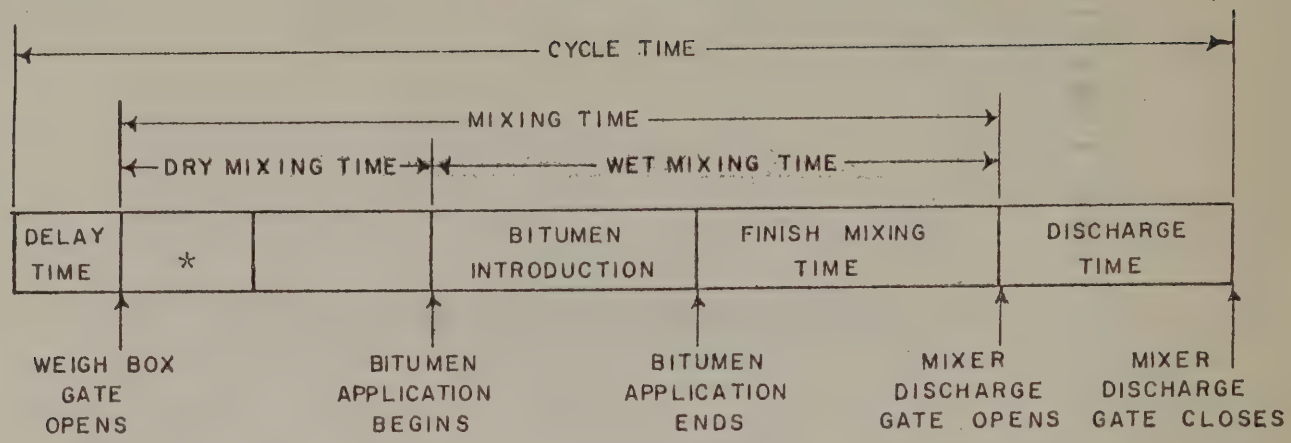


FIGURE 1 (Mixing Cycle Definitions)

III. GENERAL

Mixing times for each mix type other than the 15-second dry mix and 45-second wet mix times shall be submitted by Producers of bituminous concrete to the District Office having juridsiction over those projects to be served by the plant. Upon verification by the criteria and procedures described in this method, these times may be used in production with the written approval of the District Engineer. Both verification and approval shall be incorporated on Form BR-189 "Bituminous Concrete Mixing Times," an example of which is shown in Figure 4. When approved, copies shall be distributed to the plant Inspector, Producer, District Office and Bureau of Materials.

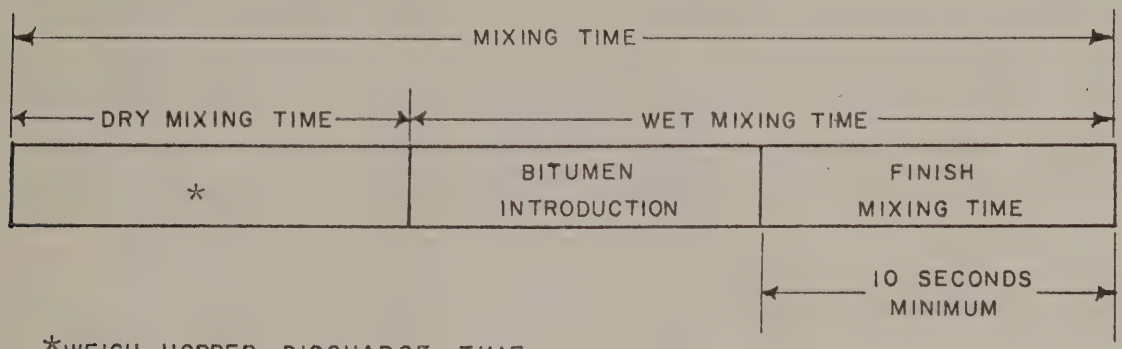
IV. CRITERIA

A. VERIFICATION OF MIXING TIMES BY ROSS COUNT

1. Base Courses

The Ross Count Method, as described under "Test Procedures," shall be the basis of evaluating the mixing time for any base course mix. The minimum Ross Count for base course mixes shall be ninety (90) percent.

In no case shall the mixing times for base course mixes be reduced so the finish mixing time is less than ten (10) seconds. See Figure 2.



*WEIGH HOPPER DISCHARGE TIME

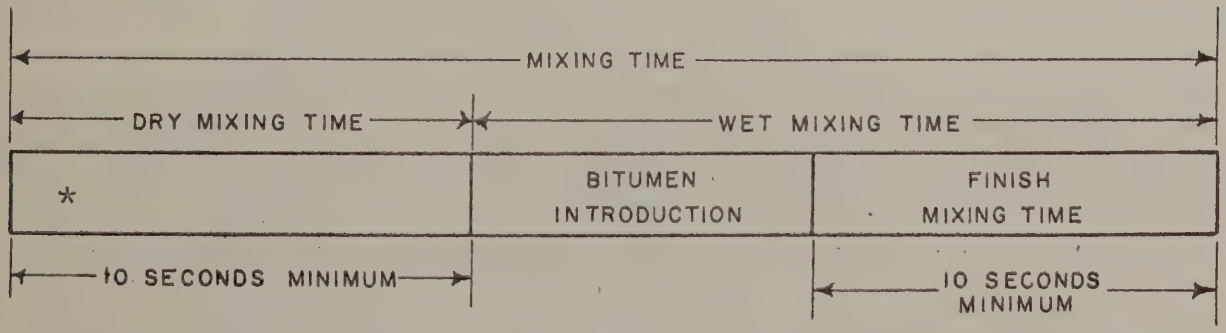
Note: In this case the dry mixing time may consist of the weigh hopper discharge time only.

FIGURE 2 (Base Courses)

2. Top and Binder Courses

The Ross Count Method as described under "Test Procedures" shall be the basis of evaluating the mixing time for any top or binder course mix. The minimum Ross Count for top and binder course shall be ninety-five (95) percent.

In no case shall the dry mixing time be less than ten (10) seconds and the finish mixing time less than ten (10) seconds. See Figure 3.



*WEIGH HOPPER DISCHARGE TIME

FIGURE 3 (Top and Binder Courses)

B. VERIFICATION OF CYCLE TIME BY UNIFORMITY AND MOISTURE TESTS

Cycle times are governed by the dryer, screen and hot bin capacities of the plant during actual production, as well as mix coating measured by the Ross Count Method. Uniformity tests as described in Materials Method N.Y. 5.3 "HOT BIN UNIFORMITY TEST" shall be performed on coarse aggregates as an indication of screen efficiency. When two consecutive tests indicate a uniformity of less than seventy (70) percent, cycle time shall be increased by increasing one or more time elements until another test indicates a uniformity of at least seventy (70) percent. Moisture and temperature determinations for the aggregates leaving the dryer shall be performed as described in Materials Method N.Y. 5.7 "AGGREGATE MOISTURE CONTENT TEST". A moisture content of 0.5 percent or less based on dry aggregate weight shall be acceptable. When the test shows excessive moisture, the bins containing the wet aggregate shall be drawn. Frequent necessity for such bin draw-down is an indication of inadequate cycle time.

V. TEST PROCEDURE

Prior to sampling, all cycle time elements (dry mix time, bitumen introduction time, etc.) shall be determined by observing the mixing operation.

A sample shall be taken from one batch in the truck. The top foot of material shall first be removed. A scoop shall be forced vertically downward and a large trowel pushed in beside it to keep material in the scoop as it is lifted out. The temperature of the mix shall be taken at this time. The sample size shall be such that from 200 to 300 coarse aggregate particles are obtained.

The Ross Count Method, as used in this test, consists of first separating the mixes' coarser aggregate particles from the finer sizes. A sieve for aggregate particle separation is selected so as to retain a significant percentage of the sample (1" or ½" for base, binder courses, ¼" for top courses).* The sample shall be transferred to the

* Should reduction of mixing time be desired for mixes too finely graded for these criteria to apply, the ability of the mixer to properly coat the particles shall be evaluated by a Ross Count run on a coarser top mix. In addition, visual inspection shall indicate a mix unquestionably satisfactory to the Inspector or longer mixing times will be required.

sieve and screened by hand. The particles are removed from the screen with a spatula and transferred to the kraft paper. Cover the sample with kraft paper to prevent dust from settling on the particles. Immediately after screening, the screen shall be brushed clean with a wire brush and, if necessary, lightly heated and brushed. The sample shall be counted while still warm. Remove the kraft paper and count from 200 to 300 particles. The particles should be counted under a strong light, preferably sunlight. Any of these aggregates having even a speck of area uncoated are classified as uncoated. The number of coated particles divided by the total number of particles expressed in percent is the Ross Count value.

If the first test results indicate that the Ross Count is above the minimum acceptable value (90% for bases, 95% for top and binder) two (2) additional tests will be conducted to verify the original results. If all mixing time test results are satisfactory, the cycle time shall be verified by checking the bin uniformities and aggregate moisture contents as prescribed previously in Section IV B.

If, in the opinion of the District, it is desirable to reduce the verified mixing times, additional tests shall be conducted.

If the Ross Count values are less than those prescribed, the finish mixing time and/or the dry mixing time shall be increased in five (5) second increments until three (3) consecutive satisfactory tests are obtained.

MM 5.10 Apr. '67

BR 169 (3/65)

FIGURE 4

NEW YORK STATE DEPARTMENT OF PUBLIC WORKS BUREAU OF MATERIALS

BITUMINOUS CONCRETE MIXING TIMES

DISTRICT 11 MIX TYPE 1A TOP DATE 6/20/67

PLANT XYZ BLACKTOP CO. (PLT #2) LOCATION NORTHTOWN, N.Y.

CYCLE TIME ELEMENTS

DELAY	WEIGH-BOX DISCHARGE	ADDITIONAL DRY MIXING	BITUMEN APPLICATION	FINISH MIXING	PUGMILL DISCHARGE
0	6	4	13	17	5
	10		30		
	TOTAL DRY MIX TIME		TOTAL WET MIX TIME		

AGGREGATE COATING TESTS

SAMPLE IDENTIFICATION	PARTICLES COATED	PARTICLES NOT COATED	TOTAL PARTICLES COUNTED	PERCENT COATED
1	294	6	300	98.0
2	248	2	250	99.2
3	262	8	270	97.0

SCREENS DRYER EFFICIENCY TESTS

BIN DESIGNATION	PERCENT PRIMARY SIZE	PERCENT RESIDUAL MOISTURE
#1	78	0.01
#1	83	—
#1A	81	NEGLIGIBLE
#1A	76	—

REMARKS ASPHALT TEMPERATURE - 290 → 300°F

MIX TEMPERATURE - 280°F ±

TESTED BY Joseph Bushey APPROVED _____ DATE _____

DISTRICT ENGINEER

5.10-6

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LRI